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EDUCATION FOR THE SOCIAL SCIENCE STUDENT[1]

By Dr. STANLEY D. DODGE

UNIVERSITY OF MICHIGAN

WHEN the Roman Republic passed its apogee near the beginning of our era, one symptom of its condition was the decline of learning. The sciences were marked out by formal boundaries, but, as Macaulay notes, there was little cultivation within the walls and no flowers and no fruit. In our times the social sciences are similarly set off from one another, and one looks nearly in vain for flowers and fruit in spite of a rather assiduous cultivation. Political science is a realm by itself, unconnected with economics and history. History has its own domain, independent of economics, political science and geography. Economics, anthropology and psychology, which should contribute to one another, pursue their separate ways, without interrelations, without mutual understanding and without purpose.

The failure of the social sciences has been a part of the failure of our whole scheme of education, and what I have to say about them might be said of other studies with only a few changes. Failure to improve the social sciences now may mean that they will sink to that level of utter futility which characterized the world of learning in Roman days. Two related troubles may be separated out for discussion. Each social science has developed a jargon of its own to so high a degree that mutual understanding is impossible. Jargon should be eradicated. If this were done, the social sciences might be able to take the next step, which is union in a common purpose.

Though the students of one science ought to be able to understand those of another, economists write an

[1] Address of the vice-president of Section K—Social and Economic Sciences, American Association for the Advancement of Science, Cleveland, Ohio, September 12, 1944.

economics jargon and sociologists a sociological jargon, instead of in terms the historian, the political scientist and the layman can understand. This statement is not intended to imply that economists and sociologists are the only sinners. Until about a century ago, books in all fields were written in language open to the layman. Hume wrote simply and clearly even about recondite matters, there is no misunderstanding what he meant. The *Essay Concerning Population* of Malthus may be read easily even by the non-specialist. Now all that is gone. Jargon has been so highly developed that each writer tends to express himself in words which he alone knows the meaning of. For a remedy, either each reader must learn the language of each writer, or, what is simpler, each writer must be familiar enough with one common language to know how to avoid jargon. The best test of language is that intelligibility to the layman which the latter alternative implies. This means that each student must know English through and through. He must be familiar with the great literary masterpieces, for these were written for the layman. If the student takes account of what makes that kind of writing effective, he too may learn to write clearly and simply. It would seem wise, that is, to concentrate the attention of students, not on the latest books and articles written in the latest jargon, but on the best books written in the best language, even though they may not be up to the minute with the latest discoveries. By the time the student has read the latest books, new discoveries will have been made out of date anyway.

By reading what had been written clearly, students may learn not only how to write well, but also how to make their ideas clearer to themselves. It has been said truly by Malherbes, that:

> Ce que l'on conçoit bien s'ennonce clairement
> Et les mots pour le dire arrivent aisement.

There is no clear writing and no mutual understanding, then, without clear ideas. In the United States, the processes by which ideas are sorted out and made clear have been neglected. This is one reason for the rise of jargon; it tends to conceal imperfections of thought. It creates an illusion of profundity where there is none. Many students are unaware that clear-cut ideas are possible. Teachers could hardly do better than to start the social science student on a course which might lead from the "Republic" of Plato, through the "Organon" of Aristotle, to Bacon, Hume and Mill, and then back again to Aristotle. These would lay foundations for a clarification of ideas, out of which mutual understanding might soon come.

A further advantage of a literary course is that the great works of literature embody ideas which have changed, or which are changing, the world. They do not deal with picayune matters. Reading them may inculcate a largeness of view which the ordinary social science student now lacks, for they embody purposeful ideas. One hardly needs to be reminded of the significance of "The Spirit of the Laws," of the "Social Contract" and of the economic writings of Mill and Marx.

Through clarification of thought and enlargement of view students would, at the same time, learn how to recognize real problems, how to formulate them and how to deal with them. We talk a lot about the Negro "problem" and about the labor "problem." What do we do with these "problems"? We accumulate data. What do we do with the data? We can hardly do anything with them; they are much more likely to do something to us. An accumulation of data can do little more than stultify the accumulator. But, what would the case be if the student knew how to formulate genuine problems? He would know then that a problem is nothing more than an unanswered question. There is no Negro "problem"; there is no labor "problem." There are, however, problems concerning Negroes and problems concerning laborers, as there are problems concerning many other matters. One such problem might be "Are Negro factory workers more or less susceptible to industrial diseases than other classes of workers?" To this there should be a simple statistical solution, after the terms have been defined. Once clear-cut problems are set up, once clear-cut questions are asked, the methods of the social sciences are adequate, if a solution be possible at all.

The second need in the rehabilitation of the social sciences is the union of them in a common purpose, and an avoidance of cross purpose. If the "Republic" of Plato were used as a start for instruction in the social sciences, the student would be helped not only in clarifying his ideas and all that that entails, but also in becoming aware of the common purpose of the social sciences. That the same book should serve both ends can scarcely be a matter of wonder. The Greeks of the age of Plato were struggling both with the clarification of ideas and with those problems of good government which form the beginnings of the social sciences. Good government may be said to be good management by the people of their joint affairs, government itself, economic life, social life and the interests of private leisure. To the truth of these concerns the social scientist should be dedicated.

This leads, of course, to the question of what is meant by truth. Now-a-days people quote glibly the first line of Bacon's aphorism:

> What is Truth, said jesting Pilate, and would not stay for an answer.

They assume that there is, indeed, no answer. They forget the second line:

Surely there be that delight in Giddiness, and count it bondage to hold a fixed belief.

A fixed belief! Before men began to arrange the state on a money basis, before the advent of capitalism, that is, a sure belief in the Universal Christian Commonwealth determined, in part at least, what men did. The organization of the world and of men's places in the world seemed settled by status, and, within the church, by ability. There was not room, however, in terms of the belief, to benefit an increasing number of people. A new belief was needed. It was created under the name of Liberalism; but it, in its turn, has proved inadequate to the needs of increasing numbers. Another fixed belief is needed, one to which men may attach themselves passionately and in terms of which they may act for the common good. We need a new fixed belief made up of the cumulative experience of mankind as expressed by its seers and prophets, its poets and its philosophers. What the foundations of the state should be has been said many times. Donne had a vision of it when he wrote "For Whom the Bell Tolls . . ."; Hobbes, confusedly, when he penned the lines for which he is justly famous; Lincoln and Pericles, in their funeral speeches; Maritain, when he wrote of education; and Jaeger, in what is, in sharp contrast to "Mein Kampf," perhaps the greatest document to come out of the Weimar Republic. Where "Mein Kampf" carries on the tradition of Thrasymachus, Jaeger's "Paideia" follows that of Socrates. The first is easy and the second difficult, yet it is the tradition of Socrates, and his impatience with buncombe, that needs to be revived to-day.

Instead of moving in this proper sphere, social scientists have aped the natural scientists. The amazing success of the natural sciences in establishing useful laws has blinded social scientists to the fundamental difference between the world of nature and the world of man. Kepler may determine the orbit of Mars to be an ellipse, and Mars continues in spite of it to move about the sun as usual. Galilei may describe the motion of the earth, recant and then mutter under his breath that it is so, but the diurnal motion of the planet is unperturbed. When Hegel said that there could not possibly be more than seven planets, he had already been gainsaid by the discovery of the first asteroid. When, however, he pronounced that the Prussian State was the acme of political development, he made a statement the consequences of which are still plaguing us. However accurately Marx may have described the economic facts in what are known as the laws of motion of capital, his enunciation of them and the predications he made on the basis of them have shaped the motion of capital ever since. One can talk about nature without disturbing nature, but one can not talk about society without changing, in some measure, the whole course of social development.

The social scientist thus needs to know what kind of society he should teach about, for the course of human events is not independent of what he teaches. The social scientist needs to concern himself not so much with societies as with society or, to use the proper term, with the state. Since in this proper sense the state is not something imposed on individuals, but something formed by them and of them for their own benefit, the social scientist needs to know a great deal more about the nature of those composing it than can be taught him by the economist, the anthropologist or the psychologist.

Economists, by imaging a pecuniary man, have played such havoc with the understanding of the state that much that might be done has escaped them. They have been able to ameliorate neither the pecuniary lot of the majority nor the pecuniary ignorance of the minority. The central problem of the present world revolution is how to distribute equitably what it is now possible to produce. Two solutions are offered. One group of economists says that it can not be done at all, or rather that the present distribution is in itself equitable since it is in accord with economic law. The other group says that, on the contrary, the laws "discovered" by the first group are not an adequate account of what happens in the world, that with new assumptions a description can be given which is adequate because it provides a basis for positive action, as the natural sciences do. I fear that men will not wait long for a reconciliation of theories, but will press on to desired goals as fast as they may. It is for this reason that social scientists need to know what kind of state they should teach about. They need to be able to distinguish between justice and injustices in the larger political sense.

The danger of relying on anthropologists for knowledge of the nature of man resides in the fact that their knowledge of primitive man transcends their understanding of man himself. It has been a tendency among anthropologists to view their imaginary man as representing the upper limit of possible human development, instead of as a lower limit from which the whole of human civilization has been built up.

Similarly, psychologists have barely succeeded in doing more than inverting the picture of man drawn by the ancient Greeks. New terms (jargon, that is) do not mean necessarily that new facts have been discovered. It is a mistake to think that the current psychological view must be the correct one. Though psychologists have done much to promote an understanding of what Leibnitz more than two hundred years ago called the "unconscious," their emphasis on it does little more than justify the prolongation of an infantile state of mind beyond the point at which normal people used to begin to act in an adult way.

The "unconscious" does not represent an upper limit to possible human mental development, but rather a lower limit, above which in the process of becoming civilized, mankind has raised itself, slowly to be sure, and not without backslidings, but nevertheless with some notable successes.

It is necessary for social scientists to see to it that at their hands the world does not perish. They need to learn the lesson of history told by Gibbon:

> If a man were called to fix the period in the history of the world during which the condition of the human race was most happy and prosperous, he would, without hesitation, name that which elapsed from the death of Domitian to the accession of Commodus. The vast extent of the Roman Empire was governed by absolute power, under the guidance of virtue and wisdom. The armies were restrained by the firm but gentle hand of four successive emperors, whose character and authority commanded involuntary respect. The forms of the civil administration were carefully preserved by Nerva, Trajan, Hadrian, and the Antonines, who delighted in the image of liberty, and were pleased with considering themselves as the accountable ministers of the laws. Such princes deserved the honor of restoring the republic, had the Romans of their day been capable of enjoying a rational freedom.

The historian will note the circumstances of the subsequent decline and fall of the Roman Empire; how for a long period the Roman emperors were without virtue or wisdom or that character which elicits involuntary respect; how they were unable or unwilling to control the evils of military power; how they ignored the abuses of public and of private revenues; how they were indifferent to the corruption of morals and the decline of learning. He will note, too, the circumstances of reform; how a new and uncorrupted people, whose character has been delineated by Tacitus and by Kingsley, brought the evils of the Roman system to an end; how a new and uncorrupt religion smoothed, in some measure, the processes of reform. If he does this he will add that the historian may yet again speak, in virtue of his profession, with all the moral authority that Gibbon was capable of. If the historian and the other social scientists are unable or unwilling to do this, others will, even though they may be less capable than social scientists might become. Socrates will be ignored and Thrasymachus exalted. Learning in the social sciences, indeed in all the sciences, will then undergo its last and inevitable eclipse.

What is needed is a genuine science of politics. The political scientist can not build such a science alone, for he is too much concerned with the empty formulae of constitutions. A genuine science of politics would have as its ideal a community, a commonwealth or a state, of free men cooperating in all the great concerns of life, achieving, that is, a rational freedom. It would so order its component sciences that each would be at once a support of the central idea and a system of thought useful in the solution of practical problems. It would not concern itself with the perpetuation of sophisms, but, undisturbed by shibboleths, it would deal in a realistic way with the work, wealth, health and happiness of mankind.

THE SIGNIFICANCE OF BIOCHEMICAL UNITS IN INFLAMMATORY EXUDATES[1,2]

By Dr. VALY MENKIN
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VARIOUS observations made in the last few years indicate the presence of some biochemical units in exudates, capable in turn of reasonably explaining a number of basic mechanisms concerned in the development of the inflammatory reaction.[3]

Inflammation is a fundamental phenomenon occurring in higher animals. It involves lymphatic structures, vascular channels and the locally affected tissue. It is initiated by a disturbance in fluid exchange. The normal capillary filtration equilibrium is markedly deranged. One of the major changes is an increase in capillary permeability. This is readily demonstrable by the seepage of material introduced into the circulation. Diazo dyes (*e.g.*, trypan blue), ferric chloride, graphite particles and bacteria will readily concentrate from the circulation into acutely inflamed foci.[3] Since the increased capillary permeability is an initial stage in the progress of inflammation it is of prime importance to obtain some understanding of the mechanism involved in order to clarify somewhat the development of subsequent sequences.

The early work of Lewis postulated that the increased capillary permeability in inflammation is referable to the presence in wheal fluid of a hypothetical H-substance which presumably is histamine

[1] From the Department of Pathology, Duke University School of Medicine, Durham, N. C.
[2] An address presented at the University of North Carolina Medical School on December 13, 1944.
[3] Valy Menkin, "Dynamics of Inflammation." New York: Macmillan Company. 1940.

r at least a substance closely related to histamine.[4] Without going into too much detail, subsequent tudies have failed to substantiate this view.[5] The llowing observations have suggested that there is berated into exudates a substance which seems to ave no direct biological relation to histamine[6]:

Exudative material is introduced into the normal kin of a rabbit. This is immediately followed by he intravenous injection of trypan blue. The dye apidly accumulates into the treated area, indicating he probable presence of a permeability factor in xudate. This factor is absent in blood serum and the eaction is not elicited by physiological saline. The ctive substance is heat stable and it is diffusible hrough a Cellophane membrane. By treating exuda- ive material with pyridine and then acetone to re- ove proteins, a crystalline active material can be ecovered in a butyl alcohol mother liquor. The ctive material is also carried down by treating exu- ative material with ammonium sulphate at one-half aturation. It is biuret negative, but ninhydrin posi- ive. The xanthoprotein test for the phenyl group s positive. The Million test is negative, but the damkiewicz color reaction for the indole nucleus is ositive. It seems to be a peptide to which a pros- hetic group may well be attached.[7] Studies on the nzymatic effect of crystalline trypsin on an other- ise inert serum albumin or whole serum suggest that he biological activity may in large part be confined o the peptide linkage.[8] Amino nitrogen measure- ent before and after hydrolysis indicates the pos- ibility that the active principle may be a relatively imple peptide. The factor not only increases capil- ary permeability, but it also induces the migration of polymorphonuclear leukocytes through the capil- ary wall. This chemotactic property can be demon- trated by *in vitro* studies as well as by *in vivo* bservations.[3] The substance has been called *leuko- axine.* Its liberation offers a reasonable explanation for the primary mechanism of increased capillary permeability and migration of leukocytes. Chemically nd physiologically, as mentioned previously, it seems o have no relation to histamine.[3] Increased capillary permeability allows the free passage of plasma pro- teins from the circulation into the extracapillary spaces. Fibrinogen is converted to fibrin with the release of thrombokinase following injury to cellular structures. A network of fibrin is formed in tissue distended with edema, and lymphatic channels become plugged with fibrin, thus inducing a lymphatic block- ade. It is the early lymphatic obstruction which pre- vents the ready dissemination of material or micro- organisms from a focus of acute inflammation. This phase of the earlier studies offers a significant con- tribution to our understanding of the rôle of inflam- mation in immunity.[9]

Leukotaxine accounts for the local migration or diapedesis of leukocytes to the site of injury. It has no effect on the number of circulating leukocytes. Yet a leukocytosis is the frequent accompaniment of numerous inflammatory or infectious processes. The whole exudate of an animal or of man having con- comitant leukocytosis with inflammation is in turn capable of inducing a rise in the number of circulat- ing leukocytes upon injecting the material into the blood stream of an otherwise normal dog. There is thus present in exudative material a *leukocytosis- promoting factor* liberated by injured cells.[10] The leukocytosis-promoting factor, or as termed the LPF, is non-diffusible and thermolabile. It is protein in character. It is obtained from the exudate by treating the latter with ammonium sulphate at one- half saturation after removal of the euglobulin frac- tion.[11,15] It seems to be either a pseudo-globulin or at least it is closely associated with that fraction of exudate. The LPF induces not only a discharge of immature leukocytes from the bone marrow, but it likewise causes a marked hyperplasia of granulocytic and megakaryocytic elements in the bone marrow.[12] The presence of the leukocytosis-promoting factor is demonstrable only in the serum of an animal having concomitantly an acute inflammation but not in a normal animal's blood serum. The liberation of the LPF into exudative material and its absorption into the circulation offers a reasonable explanation for the leukocytosis frequently associated with inflamma- tory processes. Its apparent non-antigenicity and its leukocytic forming property in the marrow suggest definite clinical application, especially since it is well known that the prognosis of numerous infectious processes is largely referable to the number of circu- lating leukocytes.[13]

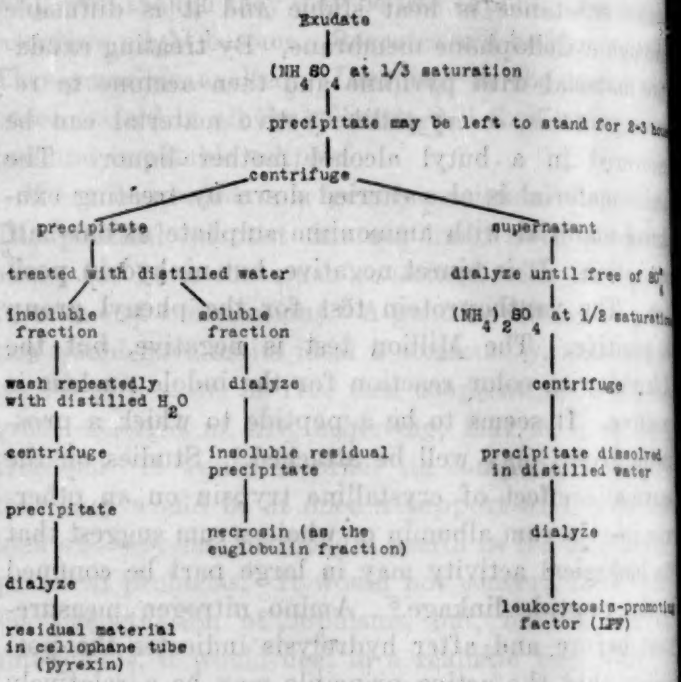
Inflammation is a manifestation of severe cellular injury. Neither leukotaxine nor the leukocytosis- promoting factor are *per se* capable of reproduc- ing the pattern of injury discerned in acute inflam- mation. This, in turn, seems to be referable to the liberation of a substance located in or associated with the euglobulin fraction of exudate, particularly when the latter has an acid reaction when withdrawn

[4] Sir T. Lewis, "The Blood Vessels of the Human Skin and Their Responses." London: Shaw and Sons, Ltd. 1927.
[5] Valy Menkin, *Jour. Exp. Med.*, 64: 485, 1936.
[6] *Ibid.*, 67: 129, 1938.
[7] *Idem*, Alexander's "Colloid Chemistry," Vol. V, 917, 1944.
[8] *Idem, Jour. Exp. Med.*, 67: 153, 1938.
[9] *Idem, Physiol. Rev.*, 18: 366, 1938.
[10] *Idem, Am. Jour. Path.*, 16: 13, 1940.
[11] *Idem, Arch. Path.*, 30: 363, 1940.
[12] *Idem, Am. Jour. Path.*, 19: 1021, 1943.
[13] *Idem, Proc. Soc. Exp. Biol. and Med.*, 56: 219, 1944.

from the site of inflammation. This substance has been termed necrosin.[14] The introduction of necrosin into the skin of a rabbit is followed within several minutes by swelling and fusion of the collagenous bundles. This type of response is not duplicated by the euglobulin fraction derived from normal blood serum. When necrosin is maintained in cutaneous tissues for longer intervals, a marked inflammation develops characterized by intense redness, edema and superficial necrosis. An abundance of leukocytes may be found in such areas. Lymphatics are occluded by fibrin and evidence of thrombosis may be seen in vascular structures. The euglobulin fraction of normal blood serum fails to induce lymphatic blockade, which in turn is an evidence of severe damage. In contrast to the leukocytosis-promoting factor necrosin induces a marked leukopenia. Vomiting, diarrhea and general apathy are also not infrequent occurrences. The intravascular injection of necrosin may be followed by the formation of fluid in the chest cavities or of hemorrhage all along the length of the gastrointestinal tract. But more constantly, following intravenous injection of necrosin, one encounters damage to the liver in the form of areas of focal necrosis. The kidneys may show foci of leukocytic infiltration interspersed among tubules that reveal evidence of fuzziness of their epithelial lining and vacuolation of the cells. The picture is not wholly dissimilar to that seen in pyelonephritis. The leukopenia following necrosin injection is often followed after several hours by a rise in the number of circulating leukocytes.* It is possible that the latter is referable to secondary damage to visceral structures by necrosin liberating, as a consequence, an appreciable amount of leukocytosis-promoting factor. The fact that necrosin penetrates from an area of injury into the circulation and thus damages essential structures may prove of clinical significance in our further understanding of the significance of foci of infection. Necrosin is found also to be lethal to mice in contrast to other protein fractions of exudate.[15]

At first it was found that the whole euglobulin fraction of exudate reproduces not only the pattern of injury seen in inflammation, but that its intravascular injection was likewise followed by the development of fever. Subsequent studies have indicated that whereas necrosin is labile, its pyrogenic component is heat stable. It was soon recognized that the euglobulin fraction of exudate had a component insoluble in the presence of electrolytes. By differential solubility this component was dissociated from a true euglobulin, which in turn behaved as necrosin. The latter induced damage to the skin of rabbits and proved lethal to mice. Observations, still preliminary in nature, have suggested the possibility that necrosin is a proteolytic enzyme. After purification necrosin was found to be essentially non-pyrogenic. The present scheme utilized to extract the leukocytosis-promoting factor, necrosin, and the insoluble pyrogenic component is shown in Table 1. The pyrogenic component may well be an end product of proteolysis initiated by necrosin. It has been termed *pyrexin*. Besides its effect on the elevation of temperature in the dog, pyrexin induces appreciable fever in the rabbit.[16,17] The whole exudate causes an elevation of temperature in that animal. This, in turn, is duplicated by the whole euglobulin fraction of exudate. This is the only protein fraction of exudate capable of reproducing this phenomenon. Pyrexin, recovered from the euglobulin fraction of exudates, by its insolubility in the presence of electrolytes (in contrast to necrosin), induces marked fever. Its absorption may offer a reasonable explanation for the development of fever with inflammation. Pyrexin is heat stable. Boiling fails to alter essentially its activity. It seems to be excreted, at least in part, in the urine. Its exact chemical composition is unknown. The biuret reaction is positive only in minute trace. The xanthoproteic test is positive. It is ninhydrin positive except in the material recovered from urine. Studies are now under way in an endeavor to obtain

TABLE 1



[14] *Idem, Arch. Path.*, 36: 269, 1943.

* In more recent studies, which are now in progress and which will be subsequently reported *in extenso*, it appears as if the leukopenia-inducing factor of exudates is not referable to purified necrosin *per se* but rather that it is associated with its thermostable fever-inducing fraction or pyrexin.

[15] *Idem, Am. Jour. Med. Sci.*, 208: 290, 1944.

[16] *Idem, Proc. Soc. Exp. Biol. and Med.*, 54: 184, 1943.

[17] *Idem*, SCIENCE, 100: 337, 1944; *Arch. Path.*, 39: 2[illegible] 1945.

further information concerning the chemical identification of pyrexin.

The foregoing biochemical units present in exudates help in explaining, in part at least, some of the major sequences in the development of inflammation. The altered chemistry of the injured cell liberates various common denominators, such as described above, into the exudate. It is these biochemical units, in turn, that account quite adequately for the fundamentally stereotyped reaction of inflammation.

SCIENTIFIC EVENTS

AN "AIR AGE" MAP OF THE WORLD

THE aeronautical correspondent of *The Times*, London, calls attention to the fact that the British Overseas Airways Corporation has issued a new type of world map, designed to "re-teach" geography in a form more suited to the coming "Air Age."

It points out that because the earth is a sphere and maps of the world are flat, every type of map gives a distorted picture. On a Mercator projection, now commonly used for world maps, the distortion increases according to the distance from the equator. For instance, Greenland is shown as being about the same size as South America, whereas its area is only about one tenth of that continent. Distances between widely separated places also become exaggerated, particularly in high latitudes.

At present, maps drawn on the Mercator projection are used for both sea and air navigation, but whereas ships must follow tracks which may involve long detours to avoid land masses, the aeroplane can follow the shortest route—a straight line over the earth's surface. Now that airliners are being designed to fly non-stop over long distances, a new type of map is needed which will enable the intending passenger to read accurately the distance he has to cover.

To indicate the distance from London of places all over the world which will be served by British air services, the British Overseas Airways Corporation has prepared what is known as an azimuthal equidistant projection map centered on London. Straight lines drawn from London to any other point on the earth's surface will show accurately the distances separating them, though not necessarily the route which will be followed.

On the azimuthal equidistant map a straight line indicates a Great Circle course, but such a direct route is not likely to be followed by air services in the years immediately after the war unless it happens to serve big centers of population or important business areas. Such routes, in general, will not be used for air services until there have been further developments in the speed, range and economics of long-distance flying.

The British Overseas Airways Corporation's object in producing an "Air Age" map now is to encourage the teaching of this new conception of geography in schools, so that boys and girls will grow up to be air-minded.

PILOT TEACHING COURSES IN CANCER

THE need for the immediate establishment of "pilot teaching courses" in cancer for third and fourth year medical students was unanimously agreed upon by the National Advisory Cancer Council, which met on April 7 at the National Cancer Institute of the U. S. Public Health Service.

The council, headed by Surgeon General Thomas Parran, stated that definite emphasis should be placed on the early diagnosis of cancer which is now the second cause of death in the country. It was pointed out that the general practitioner is the "first line of defense" in cancer control and the courses should be "slanted" toward making graduating medical students "cancer conscious."

It is planned to stimulate the setting up of "pilot courses" with the working curricular committees of leading medical schools throughout the country. This will be done by the council joining hands with other foundations interested in cancer control and research.

Long-range postwar planning of cancer research programs was also considered and it was agreed that support for research programs should be guaranteed for periods ranging from five to ten years, instead of one year at a time, as has been done in the past.

In order to meet increasing demands for cancer specialists Dr. Parran explained that the Army has offered full cooperation in channeling news of Public Health Service fellowships in cancer to physicians in the armed forces possessing cancer experience. Dr. Parran said, "Of course, these men will be entitled to additional training under the GI Bill of Rights and when this is exhausted they can avail themselves of our fellowships."

Another topic discussed was the possibility of developing cancer specialists within each state to serve as consultants to physicians in rural and urban areas.

Three grants-in-aid for cancer research were approved at the meeting. They were made for one year to the School of Medicine of Washington University, St. Louis, for photometric histochemical study of tumors—$5,000; Barnard Free Skin and Cancer Hospital, St. Louis, for one year—$5,000 for the study of the integration of changes in experimental carcinogenesis; an additional grant of $5,000 was made for two years to the Barnard Free Skin and Cancer Hospital for the measurement of carcinogenicity of residue oils.

Dr. R. R. Spencer, chief of the National Cancer Institute, presented a report on the work of the institute since the last council meeting. Two new council members, Dr. Frank E. Adair, president of the American Cancer Society, Inc., and a staff member of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, and Dr. A. C. Ivy, professor of physiology at the Medical School of Northwestern University, were present for the first time in their official capacities.

Other members present were Dr. James B. Murphy, of the Rockefeller Institute for Medical Research, New York; Dr. George M. Smith, of the School of Medicine of Yale University, and Dr. Sherwood Moore, director of the Mallinckrodt Institute of Radiology at St. Louis.

THE SUGAR RESEARCH FOUNDATION

THE following grants are announced by the Sugar Research Foundation, an association of growers and processors of cane and beet sugar, which is sponsoring research into new industrial and nutritional uses for sugar. Dr. Robert C. Hockett is the scientific director. The awards amount to $45,400, bringing to the sum of more than $300,000 the funds that the foundation has made available to science for this purpose. Those to whom the grants are made are:

Dr. Pauline B. Mack and associates of the Ellen H. Richards Institute, Pennsylvania State College, $20,000 for one year, to measure the effect of high and low sugar-containing diets upon the health, growth and physical condition of children.

Dr. Rachmiel Levine, director of metabolic and endocrine research at the Michael Reese Hospital, Chicago, $7,500 for one year, to study the physiological behavior of levulose, a sugar produced by the inversion of ordinary sugar.

Professor I. L. Chaikoff, associate professor of physiology at the University of California, $7,400 for two years, to study the protective action of sugar against cirrhosis of the liver.

The Natural Resources Research Institute of the University of Wyoming, $4,000 for one year, to investigate utilization of pectin from the pulp of sugar beets and to study derivatives of beet pectin.

Dr. Dora Stern, literature consultant, $4,000 for one year, to devise a system for classifying sugar derivatives, and to compile a list of new derivatives discovered since 1930.

Dr. I. M. Rabinowitch, of the Medical School of McGill University, Montreal, $2,500 for one year, to study further the body's relative rate of absorption of sucrose, dextrose and levulose.

Members of the foundation include growers and processors of beet and cane sugar from the continental United States, Hawaii, Puerto Rico, Cuba, Canada and Haiti. Joseph F. Abbott, of New York, is president.

THE EIGHTH ANNUAL AMERICAN DESIGN AWARDS LUNCHEON

AT the eighth annual American Design Awards luncheon on April 19, tribute was paid to the thousands of civilian scientific men who were mobilized for war and without whose achievements the war could not have been waged. An award of $25,000 was presented by Walter Hoving, president of Lord and Taylor, to the National Academy of Sciences. Dr. Frank B. Jewett, president of the academy, accepted the award.

Six distinguished men of science were honored individually for the great contributions they and the organizations under their leadership have made to the war effort. It was at the request of these men that the entire sum of $25,000 was presented to the academy as the body which represents all scientific endeavor in America. They are:

Dr. Vannevar Bush, director of the Office of Scientific Research and Development.

Dr. James B. Conant, chairman of the National Defense Research Committee.

Dr. Karl T. Compton, chief of the field service for the National Defense Committee.

Dr. A. Newton Richards, chairman of the Committee for Medical Research.

Dr. Jerome C. Hunsaker, chairman of the National Advisory Committee for Aeronautics.

Dr. Ross G. Harrison, chairman of the National Research Council.

Tribute was also paid to Major General William F. Tompkins, director of the Special Planning Division of the War Department, and Rear Admiral Julius A. Furer, co-ordinator of research and development of the Navy Department, who insured the unbroken flow of the materials of war from the laboratories to the front lines.

Speakers at the luncheon included Undersecretary of War Robert P. Patterson, who expressed the deep-felt gratitude of the armed forces to the civilian scientists who aided in the prosecution of the war; and Dr. Karl T. Compton, president of the Massachusetts Institute of Technology and chairman of the Research Board for National Security, who asserted that scientific research into new weapons of warfare must continue after the war in order that American liberty shall remain secure.

Guests of honor at the luncheon included Brigadier General Georges F. Doriot, Vice Admiral Leary, Gerard Swope, Mrs. Lytle Hull, the former Nobel prize winner, Dr. Clinton J. Davisson, Harvey N. Davis, Robert J. McKim, Mrs. George B. St. George, Mrs. George F. Baker, Lieutenant General George Grunert, Mrs. Winthrop Aldrich, Thomas J. Watson, Miss Anne Morgan and William Church Osborn.

SCIENTIFIC NOTES AND NEWS

THE Egleston Medal for 1945 of the Alumni Association of the Engineering Schools of Columbia University has been awarded to Dr. Richard Erwin Dougherty, vice-president of the New York Central Railroad System.

THE Charles V. Chapin Memorial Award was presented at the February meeting of the Rhode Island Medical Society to Dr. Reginald Fitz, Boston. In 1944 the Providence City Council passed an ordinance creating a standing committee of the council to be known as the Dr. Charles V. Chapin Memorial Award Committee. The award consists of a medal to be presented to the speaker who delivers the Chapin Memorial Oration during the annual meeting.

DR. ZAY JEFFRIES, of the General Electric Company, Pittsfield, Mass., was presented on March 7 with the newly established annual powder metallurgy medal of the Stevens Institute of Technology. The medal, which was presented for the first time by President Harvey N. Davis, on behalf of the trustees, is made entirely from powdered metals. It is awarded for "outstanding work in the field of powder metallurgy" to the person selected to deliver the annual powder metallurgy lecture.

DUE to the cancellation of the annual meeting of the American Association of Cereal Chemists, which was originally planned to be held at Toronto, the New York Section of the association will sponsor a dinner meeting at the Hotel New Yorker on May 15 when the Thomas Burr Osborne Medal will be presented to Dr. John C. Baker, of Wallace and Tiernan Company, Inc.

CAMERON Prizes for 1945 "for a highly important and valuable addition to practical therapeutics" have been awarded by the Senate of the University of Edinburgh to Sir Alexander Fleming in recognition of his discovery of penicillin, and to Sir Howard Florey in recognition of his work in making possible the clinical application of penicillin.

A RECEPTION and dinner in honor of Dr. Karl F. Stahl, chairman emeritus of the Pittsburgh Section of the American Chemical Society, preceding its meeting in Pittsburgh, was given on March 15. Dr. Stahl, who celebrated his ninetieth birthday on March 14, was chairman of the Pittsburgh Section in 1916; since 1932 he has been chairman emeritus. He has been a member of the American Chemical Society since 1896. About sixty-five members of the section and friends of Dr. Stahl attended the birthday dinner at the University Club, where he was presented with a birthday cake, a box of cigars and the best wishes of the section by Dr. H. K. Work, chairman.

THE Portuguese Government and its Premier Salazar have conferred on Dr. J. C. Geiger, director of public health of San Francisco, the Cavaleiro da Orden de Cristo with the following citation: "For great personal and professional merit in public health, and for important services to the Portuguese people of Portugal and of California."

DR. HUGH CABOT, formerly dean of the Medical School of the University of Michigan, was the principal speaker at a dinner given on April 21 at the Hotel Commodore, sponsored by the medical profession division of the Spanish Refugee Appeal. Dr. Harlow Shapley, director of the Harvard College Observatory, was among the speakers. The dinner was originally to have been in honor of Dr. Walter B. Cannon, professor emeritus of physiology at Harvard University and honorary chairman of the Boston committee of the Spanish Refugee Appeal. Dr. Cannon, who is now in Mexico City, cabled that illness would prevent him from going to New York. The proceeds of the dinner will be used to provide medical care for Spanish Republican refugees in France.

DR. ROBERT K. BURNS, JR., research associate in experimental embryology at the Carnegie Institution of Washington, has been appointed honorary professor of zoology in the department of biology of the Johns Hopkins University.

DR. WILLIAM A. DREYER has been promoted to an associate professorship of zoology at the University of Cincinnati.

MARTHA E. STAHR, now holding the Alice Freeman Palmer fellowship from Wellesley College and engaged in research at the Lick Observatory, has been appointed instructor in astronomy at Wellesley College.

DR. A. P. LORZ has recently joined the staff of the Agricultural Experiment Station of Purdue University. He will devote the major portion of his time to problems concerned with the breeding of vegetable crops suitable for the Indiana canning industry.

DR. OSCAR ZARISKI, professor of mathematics at the Johns Hopkins University, and Dr. Kenneth E. Caster, of the department of geology of the University of Cincinnati, have been appointed exchange professors to the Escola Politechnica of São Paulo, Brazil.

DR. ARTHUR R. COLMER, of the University of Texas, has been appointed associate bacteriologist at the College of Agriculture of West Virginia University.

DR. COLLINS VEATCH, formerly senior agronomist with the Food Production Mission of the Office of the Coordinator of Inter-American Affairs, has become associate professor of agronomy and associate agronomist at the Agricultural Experiment Station of West Virginia University. He took up his new work on April 1.

G. E. BLACKMAN, who since 1935 has been lecturer in plant ecology at the Imperial College of Science and Technology, London, has been appointed Sibthorpian professor of rural economy at the University of Oxford.

DR. NORMAN FEATHER, F.R.S., of the Cavendish Laboratory of the University of Cambridge, has been appointed professor of natural philosophy at the University of Edinburgh, in succession to the late Professor C. G. Barkla.

THE title of professor of chemical pathology in the University of London has been conferred on Dr. E. J. King in respect of the post held by him at the British Postgraduate Medical School.

THE American-Swedish News Exchange reports under date of April 4 that, "thanks to the Swedish Legation in Budapest, the life of the Hungarian Nobel Prize winner, Szent-Gyorgyi, has been spared."

DR. WILLIAM WEBER COBLENTZ, chief of the radiometry section of the National Bureau of Standards and known for his work in radiometry and related fields, retired on December 1, 1944.

THE retirement is announced of Dr. Addams S. McAllister, assistant director of the National Bureau of Standards, in charge of commercial standardization.

DR. DAVID I. MACHT has resigned his position as director of pharmacological research for the drug firm Hynson Westcott and Dunning, Inc. He will become consultant and research pharmacologist in the Sinai Hospital, Baltimore.

ON reaching the age limit, Thomas Rowatt has recently retired from the directorship of the Royal Scottish Museum, which he has held since 1934. He has been succeeded by Dr. Douglas A. Allan, formerly director of the Liverpool Public Museums.

DR. CHARLES-EDWARD AMORY WINSLOW, director of the School of Public Health of Yale University, will make a survey of health and hospital facilities in the Washington metropolitan area for the Metropolitan Health Council of Washington.

DR. VELMER B. FISH has resigned from the West Virginia Agricultural Experiment Station to become associated with the Baker Chemical Company at Phillipsburg.

THE newly appointed Chemistry Advisory Council of the University of Pittsburgh met on April 5. Members of the council are Francis C. Frary, director of research of the Aluminum Company of America; Paul D. Foote, executive vice-president, Gulf Research and Development Company; Herbert N. Riley, vice-president and director of research, H. J. Heinz Company; H. H. Schrenk, chief chemist, Pittsburgh Station, U. S. Bureau of Mines, and Leonard H. Cretcher, assistant director of the Mellon Institute of Industrial Research. The council met with Hurd W. Safford, executive assistant; Bernard F. Daubert, executive research assistant, and Alexander Silverman, head of the department of chemistry in the university.

DR. OTTO KLINEBERG, professor of social psychology at Columbia University, will go next August to Brazil as exchange professor to teach graduate students and to establish a department of psychology at the Escola Politechnica of São Paulo. He will receive a supplementary grant for this work from the U. S. Department of State, as part of its program for facilitating such exchanges.

DR. DEREK DENNY-BROWN, professor of neurology in the Harvard Medical School and director of the Neurological Unit, Boston City Hospital, has been granted leave of absence. He will return to active military duty as a Brigadier-General with the British forces in India and Southeast Asia. In 1941, after two years of service in the field, he was temporarily released by the British Army to carry on research and teaching in the United States. He plans to resume his work in Boston at some later date.

DR. CHARLES E. FRILEY, president of Iowa State College, and Dr. I. E. Melhus, head of the department of botany and plant pathology, have left for Mexico, Guatemala and Costa Rica. They will spend a month in these countries studying the research work with corn and other economic plants which was initiated last year by the college, and will confer with the ministers of education and agriculture on problems of mutual interest in education and in agricultural activities. In addition, possibilities of centralizing and expanding work in research and education that falls within the scope of activities of Iowa State College will be considered.

THE tenth annual Hughlings Jackson Memorial Lecture of the Montreal Neurological Institute will be delivered on May 9 by Dr. Stanley Cobb Bullard, professor of neuropathology at the Harvard Medical School and psychiatrist-in-chief of the Massachusetts General Hospital. The subject will be "Some Observations on Neurocirculatory Asthenia." Following the address, a specially bound volume of the "Selected

Writings of John Hughlings Jackson," edited by James Taylor, will be presented to the lecturer.

BRIGADIER HUGH W. B. CAIRNS, Nuffield professor of surgery at the University of Oxford and consultant in neurologic surgery to the Royal Army Medical Corps, delivered the Charles H. Mayo Lecture in Surgery of Northwestern University on April 20. His subject was "The Treatment of War Wounds of the Head."

THE Edward K. Dunham Lectures for the promotion of the medical sciences of Harvard University will be given by Dr. Vincent B. Wigglesworth, F.R.S., director of the Agricultural Research Council Unit of Insect Physiology of the London School of Hygiene and Tropical Medicine. His subject will be "The Insect as a Medium for the Study of Physiology." The lectures will be given at five o'clock at the Harvard Medical School on May 7, 9 and 11.

PROFESSOR HARLEY J. VAN CLEAVE, of the University of Illinois, on April 14 addressed the Illinois Dietetics Association in Chicago on "Diseases which Might Become Abundant after the War."

THE Firestone Tire and Rubber Company, Akron, Ohio, plans to open soon its new laboratory, which has been built at a cost of $2,000,000. A preview has been arranged for the American Institute of Chemists.

THE James F. Lincoln Arc Welding Foundation is offering awards amounting to $20,000 to encourage the preparation and publication of text-books, one on modern machine design and a second on structural design by all processes, including welding, for the instruction and study of undergraduates in engineering. In each class there are offered first, second and third awards of $5,000, $3,000 and $2,000, respectively. Manuscripts should be sent by registered mail or insured express not later than May 15, 1946, to the Secretary of The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio, from whom further information can be obtained.

THE Westinghouse Educational Foundation has provided three fellowships in electron optics at the Ohio State University—one post-doctoral fellowship with a stipend of $3,000 per year and two pre-doctoral fellowships with stipends of $1,000 per year. These fellowships are open to graduates in physics, mathematics and electrical engineering. Application forms may be secured from the Dean of the Graduate School of The Ohio State University, Columbus.

THE Francis Shimer College, Mount Carroll, has received a bequest from the late Dr. Blanche M. Haines of $20,000 to set up the George R. Moore Memorial Fund to be used to improve and promote the teaching of sciences.

DISCUSSION

FOURTH OUTBURST OF NOVA (T) PYXIDIS

DR. ALFRED H. JOY, astronomer at the Mount Wilson Observatory at Pasadena, Calif., has found that the recurrent nova, T Pyxidis, is again increasing in light. This makes the fourth rise to maximum in the past fifty-five years; in 1890, 1902, 1920 and 1945. On the first three occasions the nova attained the seventh magnitude, an increase of seven magnitudes from normal minimum brightness. Dr. Joy reports that by April 3 the nova had increased three magnitudes on the present rise to maximum.

There are not many recurrent novae known. Nova (RS) Ophiuchi has had two outbursts, in 1898 and 1933, while Nova (U) Scorpii has had three outbursts, in 1863, 1906 and 1936.

Dr. Joy finds the background (continuous) spectrum of Nova Pyxidis to be weak, with strong, bright bands and lines projected upon the background—a condition that generally prevails for novae.

Nova Pyxidis has been on the observing list of variable star observers for the past twenty years, in the hope that some observer might catch it on the rise to maximum. For northern observers, the star is unfavorably placed for observation—thirty degrees below the celestial equator. It is of about magnitude fourteen at minimum and thus is a very difficult star to watch. Observers should now follow the nova closely, not only to study its light variations, but also its spectral changes.

LEON CAMPBELL

THE CONCEPT OF A "STRAIN" IN BACTERIOLOGY

IN most fields of biology "strain" refers to a genetically distinct group within a variety or within a larger biological group when that group has no subdivisions. The problem is more complex in bacteriology. Because of the strong dissociative tendency among many bacteria which tends to produce distinctly different daughter races from apparently homogeneous parent cultures, transplants of such colonies are frequently considered as separate "strains." However, they are more correctly "dissociants," using the term in its broader sense "having properties different from those of the parent culture" rather than in the earlier meaning, which was based on smooth-rough differences. When such dissociants

have been cultivated for some time they may still produce further dissociants, even when single cell isolations are used and it is, therefore, simpler to refer to them as "cultures" or "growths" rather than as "strains."

Likewise, when a culture from, *e.g.*, the pharynx is plated so as to obtain discrete colonies, it is difficult to determine by simple methods whether or not the different colonies in each group of bacteria are genetically similar. Therefore, the appellation "culture" for such individual colonies is again preferable to "strain" which should be reserved for those offspring of a single "pure" culture or better still, of a single cell. Conversely, microorganisms that differ in certain biochemical properties may not necessarily be different "strains," and they should only be considered as such when it is known that they are genetically unrelated.

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SLEEP-ELECTRO-SHOCK THERAPY

IN the course of treatment of depressed patients with electro-shock therapy, two complications have occasionally arisen which have proved quite disturbing. One is the reaction of fear gradually built up in some patients as treatments are repeated. Such patients frequently refuse to continue with the treatment and are thus unable to benefit from a course of therapy which by now is recognized as being definitely helpful in such cases.[1] The other complication appears in the form of psychomotor excitability as manifested by excitement, agitation, restlessness, shouting and combativeness in patients following the orthodox electro-shock treatment. The importance of quieting such patients arises from the fact that unless forced restraint is applied these patients can damage either themselves or those in their immediate environment.

It has recently been found that both of these complications may be forestalled by the utilization of a sleep-electro-shock therapy.

This consists in the preliminary administration of an intravenous injection of an aqueous solution of pentothal-sodium in a dosage sufficient to produce sleep. The type of administration will vary with the patient. If, for example, one wishes to elicit psychogenic material during the process by the method of narco-analysis[2] a 2.5 per cent. solution is injected at a rate of 1 cc per minute. As the patient becomes drowsy, questioning can be carried on and responses noted. In other patients the injection may be made more rapidly—when 5–7 cc of a 5 per cent. solution induces prompt sleep.

While asleep, the electrodes may be applied to the patient and one of two indicators may be used as the propitious moment for applying the current. In a deeper stage of sleep the patient remains motionless. The corneal reflex is tested. When its response is noted the application of current which by the orthodox method was found to be a convulsive dose will result in a minor (non-convulsive) reaction. If, on the other hand, the current is not applied until the patient shows his first spontaneous movement then this same dosage results in a major (convulsive) reaction.

In either case the patient awakens in a calm manner and remains quite docile and friendly.

By means of this sleep-electro-shock therapy patients who would otherwise have remained untreated have continued to take treatment.[2, 3] It is hoped that others beset with the same difficulties will also find this method helpful.

Acknowledgment: The author is grateful for the supply of Pentothal-Sodium donated by the Abbott Laboratories.

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EARLY CENOZOIC FACIES IN THE ROCKY MOUNTAIN REGION

STUDIES of early Cenozoic deposits in the Rocky Mountain region reveal evidence of distinctive faunal and sedimentary facies.

Paleocene and Early Eocene assemblages of fossil mammals include members of two different faunal facies. Almost all the collections from drab Paleocene formations and a few from gray layers in red-banded Paleocene and Early Eocene deposits have been found concentrated in small "pockets" or "quarries." These faunas are composed chiefly of diminutive multituberculates, marsupials, insectivores, primates and rodents that were members of an arboreal forest community. Most of the fossils from the red-banded sediments, on the contrary, have been found scattered throughout the matrix, and these are the remains of larger terrestrial forms—"subungulates," condylarths, creodonts, artiodactyls and perissodactyls—mammals that probably lived in a savannah environment.

The consistent association of a forest fauna with drab deposits and of savannah dwellers with red-

[1] N. D. C. Lewis, H. C. Solomon and H. E. Bennett, *Amer. Jour. Psychiat.*, 101: 267, 1944.

[2] H. S. Rubinstein, "The Fear-Allaying Effect of Pentothal-Sodium in Electro-Shock Therapy." Ready for publication.

[3] H. S. Rubinstein, "The Use of Pentothal-Sodium as a Psychomotor Depressant in Electro-Shock Therapy." Ready for publication.

banded sediments suggests that the gray layers accumulated in forest swamps and the red to buff bands may have been deposited on flood plains in open country.

If these data have been interpreted correctly, it is significant that most Paleocene sediments in the Rocky Mountain region are drab whereas most Early Eocene formations are red-banded, for the situation suggests that forests were widespread in the Paleocene epoch but during the Early Eocene savannahs and forests fluctuated to produce extensive variegated deposits.

Both Paleocene and Early Eocene floral assemblages consist of warm-temperate to subtropical types, indicating humid, lowland conditions in the basins. Moreover, the presence of the same species of Early Eocene mammals in more than one basin reveals that there were no continuous topographic barriers impeding migration of lowland animals. Nevertheless, Rocky Mountain structures were being actively deformed during this interval. Hence the continuance of a humid, lowland environment suggests either that erosion kept pace with orogenic uplift and maintained a mature stage of topography, or that deformation took place without important upward movement.

In the Big Horn, Bridger, Washakie, Uinta and Piceance Creek basins the extensive red-banded fluviatile facies is conformably overlain by lacustrine deposits of Middle Eocene age. (In some areas the lake sediments began to accumulate before the end of Early Eocene time). In marked contrast to the irregular, lenticular layers of red and gray shale in the variegated deposits, the lacustrine facies is characterized by alternating units of evenly bedded shale rich in organic matter and fine-grained sandstone. A synthesis of stratigraphic sections of the Green River formation in southern Wyoming reveals that finely laminated oil shale accumulated at the center of the lake, while shoreward, the rich oil shale grades into a thinner, coarser shore facies composed of fine-grained sandstone in which freshwater gastropods and pelecypods abound, humic shale and lignite layers, and ostracode-bearing marlstone and low-grade oil shale. This facies in turn interfingers with fluviatile "Wasatch" and Bridger deposits at the margin of the basin. The Tatman formation in the Big Horn Basin is very similar to the shore facies of the Green River Formation, and probably was deposited in the open waters of a shallow lake and in forest swamps that displaced the lake from time to time.

The persistence of a lowland, warm-temperate to subtropical flora in the basins through the Middle Eocene demonstrates that Laramide deformation effected no pronounced change in the topography or the climate of the Rocky Mountain region in early Cenozoic time.

FRANKLYN B. VAN HOUTEN

SCIENTIFIC BOOKS

THE HOPI WAY

The Hopi Way. By LAURA THOMPSON and ALICE JOSEPH. Lawrence, Kans.: Haskell Institute. Chicago: University of Chicago Press. 151 pp. Illustrated. 1944. $3.00.

THIS volume is the first published result of a series of studies of American Indian tribes, conducted and sponsored jointly over a three-year period by the U. S. Office of Indian Affairs and the Committee on Human Development of the University of Chicago. As the Honorable John Collier, until recently commissioner of Indian Affairs, explains in the foreword, the project has for its aim the shedding of light on many of the administrative problems confronting the members of the Indian Service.

To a considerable degree the light generated by the authors of "The Hopi Way" comes from a merging of two techniques. Dr. Laura Thompson, an anthropologist, provides a summary of Hopi culture based on standard ethnological works; and Dr. Alice Joseph, a physician and neuro-psychiatrist, presents an analysis of Hopi personality as revealed by a number of psychological and psychiatric tests. The subjects tested were children, aged six to eighteen, from the pueblos situated at First and Third Mesas in Arizona. A total of 190 boys and girls were investigated in the field, representing about 12 per cent. of all Hopi children in the age group under consideration.

The book begins with a comprehensive but concisely written account of Hopi life and custom, placed against a background of the tribe's history and geographical environment. There then follow a group of portraits of Hopi children and a series of psychological analyses, and the work concludes with an interesting retrospect in which Dr. Thompson skilfully combines the ethnological and psychological data into an integrated picture of Hopi culture and personality.

Throughout the volume the authors are careful not to overstate their claims, emphasizing the fact that the present study "has been designed to serve as a basis for further research on the problem of Hopi administration," and humbly offering the work as a contribution "toward the development of a scientific method of cooperative social analysis. . . . " (pp. 13, 14). In view of such restraint it would ill become a reviewer to harp on the authors' mistakes; but since

the writers feel that "opposition to our findings will be more productive than inertia," the following comments are offered in a spirit of constructive criticism.

Apart from a few minor factual errors, the chief fault in Dr. Thompson's description of Hopi culture is a tendency toward over-emphasis that leads to distortion. This is most marked in her discussion of Hopi free-will-within-the-law (pp. 37 and 41). Much of her argument rests on a single connotation of the word *náwakna,* which means praying, wanting, willing, desiring. Dr. Thompson interprets it to mean willing in the sense of volition, and is thus led to exaggerate the importance of free will in Hopi philosophy. Similarly, so much is made of a Hopi linguistic phenomenon which happens to coincide with some of the concepts of modern physics, that one is almost asked to believe that the Hopi are masters of that science simply because they have a word for it.

On the whole, however, Dr. Thompson's contributions to "The Hopi Way" are stimulating and well presented, and it is too bad that her collaborator's work does not quite measure up to the same standard. Every now and then, for instance, Dr. Joseph remarks that her tests have revealed some hitherto unsuspected aspect of Hopi culture or personality, but unfortunately these claims are not always justified by the evidence. Thus, in her study of Roger, Dr. Joseph tells us that all previous reports and casual observations "did not contain *one hint* [the emphasis is mine] of the possibility of deeper-lying conflicts in his personality. The tests . . . revealed with great clarity his conflicts . . . and his inability to cope with them" (p. 88). Yet, on page 71, numerous observations made without benefit of testing reveal that Roger's "facial expression is somewhat sullen"; his overt behavior "appears shiftless and unpredictable"; his teachers said that "it was difficult to crack his shell"; he pleaded "with both his parents to let him leave home for work"; and having got away from the reservation, he "expressed the wish never to go back home again."

In a somewhat similar connection, to cite but one of many possible examples, Dr. Joseph states that the emotional response test provides "some direct information regarding concern about death and sickness" (p. 98). This may be true, but practically every scrap of such information as is contained in her subsequent discussion is old stuff to Hopi ethnologists.

I have emphasized the shortcomings of the psychological approach in "The Hopi Way" primarily because there is a growing tendency among anthropologists to incorporate psychological techniques into their field methods. If this merger is to be fruitful (as I believe it will be in the long run), great care must be taken in this early period of experimentation to make sure that the new device really does add something significant to the older procedure. So long as psychological tests and psychiatric analyses do little more than confirm conclusions that may be reached by ethnological investigation, their actual value to anthropology must remain in doubt.

The publication of the remaining studies in this series, together with the supplements devoted to concrete administrative application, will unquestionably reveal more fully than could the pioneer volume the full significance of the entire project. In the meantime, the authors of "The Hopi Way" and their sponsoring organizations are to be congratulated for having ventured into a new and promising field of social research. The Office of Indian Affairs particularly deserves credit for its support of such an enterprise. We have come a long way from the days when, as Mr. Collier has pointed out, Indian commissioners regarded it as their duty to redeem "these benighted children of nature from the darkness of their superstition and ignorance."

MISCHA TITIEV
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AMEBIASIS

The Etiology, Diagnosis and Treatment of Amebiasis. By CHARLES FRANKLIN CRAIG. 332 pp. 45 text figures. Baltimore: The Williams and Wilkins Company. 1944. $4.50.

IN 1934 Colonel Craig published his monographic volume on "Amebiasis and Amebic Dysentery." At that time the American physician and layman had recently become conscious of the hazards of this infection in the United States as a result of the epidemic of amebic dysentery in two Chicago hotels. The present volume is equally timely because of exposure of a large number of troops to this infection throughout most of the tropical areas of American military operations.

All the valuable information in the older treatise and much of the more recent data have been brought together in the new book. The subject indicates only a part of the material presented by the author, since it omits for purpose of brevity the aspects of epidemiology, pathology and symptomatology of the disease, all of which are adequately considered.

Colonel Craig has had nearly a half-century of experience with amebiasis in both its clinical and laboratory aspects. He is the one authority who could provide a proper balance between these two closely related phases of the subject. Thus, the volume is equally useful to the protozoologist and the physician. It is well documented, has good author and subject indexes, is well printed and is free of the typographical errors which frequently remain undiscovered by an author until after publication.

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REPORTS

RESEARCH AFTER THE WAR

AT the Cleveland meeting, September, 1944, a symposium was held under the auspices of the Committee on Science and Society of the American Association for the Advancement of Science on "Research After the War," a subject which has become increasingly important, especially since President Roosevelt's letter to Dr. Vannever Bush, of the Office of Scientific Research and Development (see SCIENCE, December 15, 1944).

The theme of the symposium was the need for a national policy for research, and the symposium group went on record as recommending that the Association, with, it was suggested, the collaboration of the National Academy of Sciences and the Society of the Sigma Xi, undertake to formulate a national policy for research, for discussion by scientists all over the country. In the discussion it was brought out that a national policy for research would be of value on the following points, among others:

(1) It would assert that research was a necessary, indispensable function in a progressive society, thereby affirming the place of research as more than an extraneous activity or a luxury or an ivory tower occupation. Progress in social order has been achieved largely by critical thinking and systematic, continuous research.

(2) It would declare the importance of extending systematic research into every field or activity of life, as a considered policy of critically examining whatever we believe and do, and proceeding to a revision of established assumptions and practices wherever research reveals they are required or desirable.

(3) It would recognize the implications of contemporary development of research under the diverse auspices and objectives of universities, of business and industry, and of government, and assert the obligations of scientists to maintain the standards and ethics of science, and the public interest wherever research is conducted.

(4) It would propose the careful evaluation of the use of patents by different organizations and agencies, university, business and government, in terms of their consequences for the future of science, as our cumulative cultural heritage or public domain.

(5) It would declare the need for adequate protection for the investigator from the pressures and the hazards to which he is increasingly exposed because of the growing social, political and economic significance of his research.

(6) It would emphasize the national importance, if not necessity, of providing stable and continuous financial support for research and a considered program of developing research workers according to the needs of such expanding responsibilities for research.

(7) It would recognize that the very progress of research in physical science and technology made it imperative that research in the social sciences and the humanities, especially into the traditional American patterns of thinking and action, be further developed and improved, since the growing discrepancy between our advancing technology and our established practices and organizations is one of the major threats to our free, democratic social order. The need for the exercise of critical thinking upon our folkways and our historically derived social, economic and political beliefs and patterns is no less than the need for critical thinking upon our industrial processes and technical equipment and practices.

(8) It would boldly propose research as the instrumentality which was peculiarly the resource of a free social order for resolving the conflict of aims and interests and for evaluating the objectives and practices of all groups and individuals in terms of their meaning and consequences for our democratic ideals. It may be many years before we will fully accept research in this role, but we may now project that goal ahead as one aim of a national policy for research.

(9) It would propose the establishment of governmental research as a coordinate function of government, equivalent in rank and authority to the legislative, the executive and the judiciary, recognizing that research is becoming the basis of governmental decisions and policies, just as law and the courts have been accepted over the centuries as the agency for determination of issues, the adjudication of conflicts and the formulation of orderly procedures for protecting human rights. The future of research in national life can be no less than that of the law and courts; already some of the functions of the law and courts are being performed by research to-day. A considered policy for research, as a fourth branch of government, would provide an alternative to the present uncoordinated dispersion of research among many different agencies and branches of government and the frequent subordination of research to immediate needs and expediencies.

(10) It would recognize that a national policy for research was as necessary to our survival as a nation, as is a foreign policy and a defense policy; it would urge the adoption of such a national policy to parallel the action of our principal allies, Great Britain, Russia and China, in establishing national policies for research.

(11) It would formulate for early and specific action the problems of greatest national urgency and propose that research on a scale commensurate with

those urgencies be initiated and extended through appropriate agencies in those areas. As a pattern for such research proposals, it would urge that we seek to establish in each area the relationship between research and practice in that area, which now exists between the physical sciences and engineering and between the biological-medical sciences and medicine. Moreover, it would recognize that the translation of research findings into the daily life, so that our beliefs and practices of living will be informed and guided by research, presents one of the most urgent problems, calling for systematic study of our cultural traditions and of the methods of re-education that will recognize the values in those traditions but provide more effective practices for their attainment.

(12) Finally it would mark the acceptance, by scientists and research workers of all kinds, of the need for developing some scientific statesmanship commensurate with the magnitude of the tasks ahead and with the responsibilities which research now bears and must increasingly carry in the orientation of our national life.

The issues involved in the development of a national policy for research go far beyond the many controversial questions now being debated. They relate to the more fundamental questions of insuring the continuation and the extension of critical thinking as our major resource for advancing human life and social order toward the enduring values of our cultural heritage. If we aspire to the democratic ideal of the value and worth of the human personality, the dignity of man and of woman, we should recognize that the critical thinking of research has been the instrument throughout the ages which has increasingly worked for the attainment of these human values and these democratic aspirations, as formulated in our religion and our arts.

To-day critical thinking and the powers of trained organized intelligence offer possibilities such as no previous age has ever had, for achieving human conservation and advancing our free social order. The instruments are here and their powers and scope are being rapidly enlarged. We must muster the courage and imagination to use those instruments constructively and with full realization of the long-term tasks we face. That is the purpose of a national policy for research, which is not a program or a scheme of planning and control, but a considered declaration of purpose and intentions and of basic aims, to inform individual and group action and institutional programs, to provide the criteria for their decisions and to solicit a commitment to these larger tasks, so that every one will be put on notice that what he does or fails to do will advance or obstruct our national policy for research.

The relation of science to society is more than a question of gadgets or even technology; it involves the provision of knowledge and the criteria by which we can continue the endless task of developing a social order dedicated to human needs and potentialities. This means learning to understand nature and man and his traditional culture and how man can create a way of life directed to his aspirations, as informed by critical thinking.

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SPECIAL ARTICLES

CALCIUM IN PREVENTION AND TREATMENT OF EXPERIMENTAL DDT POISONING

THE mechanism of the toxic effects of dichlordiphenyl-trichlorethane (DDT) is imperfectly known, whether in invertebrates or vertebrates. Experiments with arthropods, particularly with insects, seem to indicate a poisoning of the nervous system. Many experiments have been made with various vertebrate species, such as pigeons, rats, rabbits, cats, dogs, horses, oxen, goats,[1] frogs and goldfishes.[2] Daily doses of 100 mg of DDT per kg body-weight for a given period are responsible for symptoms which seem to show intoxication of the nervous system. In our experiments with dogs we observed that the symptoms begin with fibrillar contractions of the muscles of the hind legs which afterwards spread through the muscles of the entire body. Continuous contractions of all voluntary muscles, muscle-incoordination and inability to stand are the symptoms then observed. The animal lies down, the muscular contractions persisting for from 12 to 24 hours. As a rule, the animal recovers spontaneously; the intensity and duration of the muscular contractions depend on the dose of DDT administered. It seems to us that these symptoms are similar to those observed in dogs treated with carbon tetrachloride. Minot,[3] who noted the similarity between the symptoms produced by carbon tetrachloride in dogs and those of tetany in children, investigated the effect of intravenous injections of calcium chloride solutions on dogs in state of convulsions and unconsciousness brought about by carbon tetrachloride intoxication. A few (15 to 20) minutes after injecting the calcium chloride solution, the dogs were

[1] A. A. Nelson, *et al.*, *Pub. Health Rep.*, 59: 31, 1944.
[2] M. M. Ellis, B. A. Westfall and M. D. Ellis, SCIENCE, 100: 477, 1944.
[3] A. S. Minot, *Proc. Soc. Exp. Biol. and Med.*, 24: 617-20, 1927.

TABLE 1

THE CURATIVE EFFECT OF CALCIUM GLUCONATE INJECTED INTRAVENOUSLY IN DOGS EXPERIMENTALLY INTOXICATED BY DDT

Dog No.	Weight kg	Quantity of DDT administered up to the beginning of the experiments		Quantity of DDT administered to verify the therapeutic effect of calcium gr	10 per cent. solution of calcium gluconate injected cc	Number of experiments	Time elapsed before recovery Hours
		Daily doses gr	Total doses gr				
1	14	1.4	29.4	2.4	20	1	2
2	14	1.4	9.8	1.4	20	2	2–3
8	12	1.2	7.2	2.2	20	4	1,30–4
9	8	1.2	6.5	2.6	20	1	2
10	18	1.8	27.0	2.8	30	2	2,30–3
11	11	1.1	11.0	2.2	20	2	2–3

As Table 1 shows, calcium gluconate hastens the recovery of the intoxicated dogs. When calcium was not injected, the same dogs intoxicated by daily doses of DDT in the ratio of 100 mg of DDT per kg of body-weight recovered only 12 to 24 hours after the beginning of the symptoms of poisoning. Having induced susceptibility in two dogs (Nos. 5 and 6), doses of 200 mg of DDT per kg of body weight were given to them, and no calcium gluconate was injected. One of the dogs so intoxicated died 20 hours, the other 24 hours, after the appearance of the symptoms.

capable of standing and convulsions were no longer observed. Relapses were frequently noted, but the animals responded well to new injections of the calcium chloride solution. Minot established, too, that the addition of calcium salts to the diet, a week or longer before administering toxic doses of carbon tetrachloride, was effective in preventing the development of symptoms of intoxication.

We intended to verify if intravenous injections of convenient calcium salt solutions could prevent the display of the symptoms of experimentatal DDT poisoning in dogs. Our hypothesis is that DDT provokes a lowering of the calcium level in blood, since only relatively discrete histological lesions in the central nervous system are noticeable, notwithstanding the severe apparently neurological symptoms of intoxication.[1, 4]

Our experiments were made on dogs of undetermined race and varying age and weight. Daily doses of 10 per cent. oily solutions of DDT were administered orally in the ratio of 100 mg of the drug by kg of body-weight until symptoms of intoxication appeared. In some cases slight symptoms of poisoning were apparent after a few days, but then the animals recovered promptly and spontaneously, and only after new administrations of DDT intense symptoms were observable. Afterwards it was sufficient to give 100 mg of DDT per kg of body-weight to have intense symptoms of poisoning with spontaneous recovery 12 to 24 hours later. From then on the susceptibility of the animals to the drug increased greatly. With animals so prepared, we began the experiments to verify the effect of calcium on the development of the symptoms of poisoning, and for this purpose doses of 150 to 200 mg of DDT per kg of body-weight were given. Calcium gluconate (10 per cent. solution) was injected intravenously. In order to investigate the curative power of calcium, calcium gluconate was injected in 6 dogs with severe symptoms of poisoning; to verify its preventive effect, calcium gluconate was administered to 3 dogs, during the three days previous to their taking of DDT and also on the day of the experiment; to another 3 dogs the administration of DDT (orally) was immediately followed by an injection of calcium gluconate (intravenously), and in addition the injection of this calcium salt was repeated a few hours later.

TABLE 2

THE PREVENTIVE EFFECT OF CALCIUM GLUCONATE WHEN INJECTED INTRAVENOUSLY BEFORE AND AFTER THE ORAL ADMINISTRATION OF TOXIC DOSES OF DDT

Dog No.	Weight kg	Quantity of DDT administered up to the beginning of the experiments gr	Quantity of DDT administered to verify the preventive power of calcium gr	10 per cent. solution of calcium gluconate injected cc	Number of experiments	Results
1	14	36,8	2,8	30	2	no symptoms
2	14	30,1	2,4	80 (four daily doses of 20 cc)	2	" "
8	12	16,2	1,2	"	2	" "
9	8	10,4	1,3	30	1	slight symptoms
10	18	39,6	2,8	30	1	no symptoms
11	11	16,4	2,2	80 (four daily doses of 20 cc)	2	" "

Dog No. 11, after having received in due time 3,2 gr of DDT, could not be protected against the toxic effect of the drug by 2 injections of 20 cc of a 10 per cent. solution of calcium gluconate, one of which was administered immediately after giving DDT, the other being injected 4 hours later. Notwithstanding the high quantity of DDT taken, the dog, which presented intense symptoms of poisoning, made good recovery 8 hours after the second injection of calcium gluconate.

[4] R. D. Lillie and M. T. Smith, *Pub. Health Rep.*, 59(30): 979–84, 1944.

Satisfactory results obtained by the use of calcium gluconate in prevention and treatment of dogs experimentally intoxicated by DDT suggest that the apparent neurologic symptoms observed are consequent to hypocalcemia, and not due to direct action of DDT upon the central nervous system. It must be emphasized that the six dogs used in the experiments recorded in the present paper are all but one (No. 9) in apparently good physical condition a month after the ending of the experiments.

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STUDIES ON HUMAN PLACENTAL THROMBOPLASTIN IN VITRO AND IN VIVO

AN extract from human placenta exhibiting thromboplastic activity was first described by Sakurai.[1] Eley *et al.*[2] modified his method and prepared a product which did not prove to be highly active on hemophilic blood.[3] Recently Howell[4] prepared a substance from pig lungs of considerable purity and extraordinary potency. He also succeeded in splitting off the active phospholipid. Since human placenta can be obtained so easily, as compared with human lungs from autopsies, I applied Howell's method for that material. However, the resulting protein compound was not as active and not as soluble in alkaline water as compared with the product from human or pig lung. Therefore, a new method has been developed for both the preparation of a protein phospholipid compound and an apparently protein-free substance as tested by the Biuret reaction. In addition human thromboplastin has been prepared recently from saline plasma obtained by diluting blood 10 to 15 times its volume with physiologic saline. Detailed descriptions of the methods of preparation of both the placental and plasmatic thromboplastic substances will be given in a subsequent article.[5]

The new placental thromboplastic substances compare well in potency with Howell's product from pig lung. *In vitro,* in small doses they have caused rapid clotting of hemophilic blood. The materials contain calcium and phosphorus. They are waxy, whitish and wholly soluble in water. Because of a rather high calcium content, they can coagulate decalcified plasma without the addition of calcium chloride. A single placenta yields a large amount of these substances. Greater thromboplastic activity is obtained from the placenta proper than from the cord. In drying the material, for which several methods have been employed, some loss of potency results.

All *in vivo* studies have been made with the protein compound. Following intravenous injection into dogs, the thromboplastin shortens the coagulation time. In large doses there is an initial prolonging effect upon the coagulation time, in some cases the blood becomes incoagulable. However, after several hours the coagulation times return to their original values previous to injection and even have been found to be shortened. This shortening effect lasted between 3 to 5 days in 3 dogs, and for 2 weeks in 2 dogs. The blood-saline coagulation test of Copley and Houlihan[6] has been applied to these studies. This test allows a better measure of the coagulability of native blood than previous methods which tested only the undiluted native blood. The phenomenon of hypercoagulability for a period up to two weeks, after the introduction of human placental thromboplastin into the circulation, can not be explained at present.

Intravenous injections of human placental thromboplastin alone have been made in 15 dogs without general anesthesia. The blood pressure is either slightly lowered temporarily or not at all. There are no apparent ill effects when the thromboplastin is warmed to body temperature and injected slowly. Two dogs which were anesthetized with veterinary nembutal Abbott (0.45 cc per kgm) and thereafter treated intravenously with thromboplastin died in shock. On autopsy one dog exhibited intravascular and intracardial blood coagulation, whereas the other dog was apparently free of coagulation thrombi. This dog died of heart tamponade as a result of an intracardiac injection of adrenalin which was employed in an attempt to alleviate the acute condition of shock. The combination of placental thromboplastin and nembutal appears to produce experimental shock, a phenomenon which merits further investigation. Before the human thromboplastin can be applied *in vivo* by intravenous injections into humans, extensive studies will have to be conducted.

We used this thromboplastin as a local hemostatic in dog surgery resulting in almost instantaneous coagulation of bleeding surfaces. In experiments on coagulation thrombosis in vessel segments of arteries and veins, coagulation was found to occur in less than

[1] K. Sakurai, *Sei-i-kwai M. J.*, 48: 52, 1929. Cited by Eley *et al.* (see footnote 2).

[2] R. C. Eley, A. A. Green and C. F. McKhann, *Jour. Ped.*, 8: 135, 1936.

[3] W. H. Howell. Personal communication, April 7, 1944.

[4] W. H. Howell. Personal communication, May 18, 1943.

[5] A. L. Copley, to be published.

[6] A. L. Copley and R. B. Houlihan, SCIENCE, 100: 505, 1944.

one minute.[7] In normal dog blood which is freshly drawn, coagulation is completed in less than 10 seconds, using 1 cc of blood and 0.1 cc of thromboplastin. Placental thromboplastin is a substance which not only can be used as a local hemostatic, but promises to exert a hemostatic effect when applied parenterally or even intravenously without causing thrombosis. It can be employed in the preparation of thrombin of human origin. It activates thrombin in decalcified plasma, and can be used instead of thrombin in various clinical applications, unless purified fibrinogen solution free from other plasma fractions is preferred. In preliminary peptone shock experiments, employing Witte's product, kymographic readings demonstrated that the protein compound increases the blood pressure to its level previous to shock, and the dogs recover long before the coagulation time reaches its normal value. *In vitro,* 1 cc samples of peptone blood, in which the control remained incoagulable, were clotted in 1 minute with 0.1 cc thromboplastin. Since in 6 dogs, peptone shock was treated successfully with this placental thromboplastin, it may be of therapeutic value in anaphylactic shock, and perhaps in other forms of shock.

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RELATIONSHIP BETWEEN PATHOGENICITY AND pH TOLERANCE OF MICROORGANISMS[1]

INVESTIGATIONS on the sterilization of shoes in this laboratory necessitated the microbiological examination of "sterilized" and unsterilized worn shoes to determine the extent to which the causative agents of athlete's foot, the dermatophytes, were removed by the various sterilizing procedures. It soon became apparent that ordinary Sabouraud's dextrose or maltose agar was unsatisfactory for the isolation of dermatophytes when in the presence of the rapidly growing saprophytic fungi commonly found on shoes, floors, etc. (Rhizopus, Aspergillus and Penicillium), for it allowed such saprophytes to grow so rapidly that the agar surface, in most cases, would be covered with the growth of these fungi and thus not allow the slower growing dermatophytes to appear. This same difficulty in isolating dermatophytes was encountered by other workers.[2,3,4]

Studies were undertaken, therefore, to find a method whereby dermatophytes could be selected from mixed cultures and suspensions. Among other factors studied was that of the pH of the culture medium used to isolate the dermatophytes. As acid pH values are used to inhibit bacteria on media for mold cultivation, a series of experiments was made, using Sabouraud's maltose agar adjusted to various acidities and alkalinities and observing the growth of both dermatophytes and saprophytic fungi. As the pH of the medium was increased, the growth of the saprophytic fungi became less dense while the dermatophytes were affected only slightly in comparison. It was soon found that a procedure using Sabouraud's dextrose or maltose agar adjusted to an initial pH of 10.5 with NaOH *immediately before* the plates were poured (hereafter referred to as the *alkaline medium*) and an incubation period of 5½ days at 34° C. gave the maximum inhibition for the saprophytic fungi, while the dermatophytes were inhibited only slightly. Rhizopus and Aspergillus were inhibited almost completely, whereas Penicillium was inhibited much less. Details of this study are to be published elsewhere.[5]

The alkaline medium was tested for its effectiveness in isolating dermatophytes from mixed cultures and from leather suspensions. A marked selective action in favor of the dermatophytes was obtained, while parallel plates using ordinary Sabouraud's dextrose agar were completely covered by growth of the saprophytic fungi. In the form of freshly prepared slants, the alkaline medium can also be used for the isolation of dermatophytes from skin scrapings when saprophytic fungi are present. The full procedure for the isolation of dermatophytes in the presence of saprophytic fungi will be presented more fully elsewhere.[6]

The significant results obtained by increasing the pH of Sabouraud's dextrose of maltose agar showed that the pathogenic fungi, *i.e.,* the dermatophytes, were able by some means to grow at high pH levels while the common saprophytic fungi either did not grow or grew poorly on the alkaline medium. This suggested that pathogenicity might be related to pH tolerance. Tate's work[7] strengthened this suggestion by showing that the pathogenic dermatophytes have an active proteolytic enzyme which is effective in alkaline substrates and which resembles trypsin, while a saprophytic fungus as *Aspergillus niger* does not. This could explain the results obtained with the alka-

[7] A. L. Copley and P. L. Stefko, to be published.

[1] The work described in this paper was done in part under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Maryland.

[2] F. W. Weidman, *Penn. Med. Jour.,* 34: 695–701, 1931.

[3] Lee Bonar and Alice D. Dreyer, *Am. Jour. Pub. Health,* 22: 909–926, 1932.

[4] P. A. Neal and C. W. Emmons, *U. S. Pub. Health Service Bull.* No. 246, 1939.

[5] J. M. Leise and L. H. James, *Jr. Lab. and Clin. Med.,* 30: 119–131, 1945.

[6] J. M. Leise and L. H. James, *Arch. Dermat. and Syph.,* in press.

[7] P. Tate, *Biol. Rev.,* 4: 41–75, 1929.

line medium and could also be an explanation of pathogenicity in that pathogens may contain this enzyme while non-pathogens do not or contain it in an attenuated form. Therefore, it would appear possible to differentiate pathogenic from non-pathogenic microorganisms by growth in alkaline broth. This hypothesis was tested by using two strains of *Shigella dysenteriae* and two of *Shigella paradysenteriae* (Flexner), supplied by the National Institute of Health, with one strain of each species being virulent while the other was non-virulent. These bacteria were inoculated into tryptose broth of various pH values with the result that the non-virulent strains were inhibited by alkaline pH values at which the virulent strains were able to grow (a detailed report is in preparation).

The results obtained with the dysentery bacteria in the light of the literature suggest that the pathogenicity-pH tolerance relationship may be due to the presence of a trypsin-like enzyme or enzyme system. If this were shown to be true, it would be possible to use an anti-tryptic agent to change a virulent microorganism into a non-virulent strain and thus aid in treating infectious diseases. The excellent work of Mirsky[8] in inhibiting streptococcus fibrinolysin by trypsin inhibitors and his statement that "It is suggested that the streptococcal fibrinolysin is a protease and that it may be related to trypsin" combines with Tate's studies and our investigations in emphasizing the relationship between pathogenicity and pH tolerance and the importance of a trypsin-like enzyme or enzyme system in pathogenicity.

SUMMARY

An alkaline medium (Sabouraud's dextrose or maltose agar of pH 10.5) was found to be selective for dermatophytes in the presence of the rapidly growing saprophytic fungi and has been used to isolate dermatophytes from mixed cultures and leather. Virulent dysentery bacteria are able to grow in media of alkaline pH values, while non-virulent strains of the same microorganisms are inhibited completely or very greatly. It is strongly indicated that pathogenicity may be related to pH tolerance and it is suggested that this relationship may be explained by the presence of a trypsin-like enzyme or enzyme system, while a loss of pathogenicity is associated with a loss or weakening of this enzyme system.

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[8] I. A. Mirsky, SCIENCE, 100: 198–200, 1944.

THE NUTRITIONAL VALUE OF SUNFLOWER SEED MEAL

IN the search for new food materials of significant value in human and animal nutrition scarcely any attempt appears to have been made to critically evaluate sunflower seed. This is surprising because the sunflower (*Helianthus annuus*) is economically important and well known in many parts of the world including the United States and Canada. The production is increasing rapidly. For example, in the season of 1943–44 Argentina's output of sunflower oil amounted to 1,072,000 tons, placing that country second only to Russia as a producer.[1] In 1939–40 the production in Argentina was only 375,000 tons.

The hull-free residue remaining after removal of the oil has been used for livestock and poultry feeding. It is approximately 53 per cent. protein, the biological value of which has been found to be quite low.[2] In all probability this conclusion has been based on analyses of oil-free residue obtained by pressure extraction methods which involved severe heat treatment. Such methods are now known to markedly reduce the biological value of proteins[3] and may be regarded as injurious to certain vitamins. Mitchell *et al.*[3] have recently shown that sunflower seed meal, when produced by a low temperature, solvent extraction process, is in the same class as oats, wheat and barley in regard to the dietary quality of its protein.

Practically nothing can be found in the literature concerning the B complex values of sunflower seed or the product left after removal of the oil. For example, the word sunflower does not even occur in most standard books on nutrition, including the recent "Handbook of Nutrition" of the American Medical Association,[4] although in the latter mention is made of such unusual foods as caviar, crayfish and edible hips of the wild rose.

We have undertaken an investigation of the nutritive properties of the meal left after low temperature, solvent extraction of hulled sunflower seed (Sunrise variety). The marked ability of this product to promote growth and reproduction in rats restricted to purified diets containing it as the only source of B complex vitamins prompts this preliminary note in order that attention might be focused more promptly on this neglected, but promising food.

[1] *Foreign Commerce Weekly*, 17: 37, 1944.

[2] G. Ganchev and I. D. Popov, *Ann. univ. Sofia. F. Faculté agron. sylvicult.*, 14: 209–38, 1936; *Chem. Abstr.*, 31: 3968, 1937.

[3] H. H. Mitchell, T. S. Hamilton and J. R. Beadles, *Jour. Nutr.*, 29: 13–25, 1945.

[4] Council on Foods and Nutrition. "Handbook of Nutrition." American Medical Association, Chicago. 1943.

The following experiments illustrate the major findings. Weanling rats were divided into different groups with due regard for litter membership, sex and weight. The basal ration was: casein (vitamin-free) 15, glucose 66, salt mixture 4, hydrogenated vegetable oil (Crisco) 8, wheat germ oil (VioBin) 2, percomorph oil (Mead Johnson) two drops, and supplement 5. The supplements were respectively defatted wheat-germ meal (VioBin), defatted corn-germ meal (VioBin), defatted sunflower seed meal (VioBin), defatted soybean meal and dried brewer's yeast. In another series the supplements were given at a 10 per cent. level, instead of 5, and the glucose level was decreased accordingly. The growth results are indicated in Table 1.

TABLE 1

GROWTH RATE OF RATS FED LIMITED AMOUNTS OF LOW-TEMPERATURE, SOLVENT-EXTRACTED SUNFLOWER SEED MEAL AS THE ONLY SOURCE OF B COMPLEX VITAMINS, IN COMPARISON WITH THAT IN RATS FED SIMILAR LEVELS OF DEFATTED WHEAT GERM, CORN GERM, SOYBEANS AND BREWER'S YEAST

Supplement	Level of supplement	Average gains*	
		7 weeks	14 weeks
	per cent.	g.	g.
Wheat germ	5	47 (12)	70 (3)
Corn germ	5	46 (14)	70 (3)
Sunflower seed	5	56 (15)	119 (3)
Soybeans	5	21 (11)	.....
Brewer's yeast	5	121 (2)	180 (2)
Wheat germ	10	114 (5)	169 (5)
Corn germ	10	109 (5)	177 (5)
Sunflower seed	10	115 (5)	186 (5)
Brewer's yeast	10	180 (4)	229 (4)

* The numbers in parentheses refer to numbers of rats used.

The growth, as well as the appearance of the animals, clearly show that sunflower seed meal fed at low levels is appreciably superior even to wheat-germ and corn-germ meals at comparable levels as a source of all the necessary B complex vitamins. It is far superior to defatted soybean meal and decidedly inferior to brewer's yeast in this respect.

In experiments with other rats fed the basal ration containing 5 per cent. of the sunflower seed meal the growth rate was not accelerated by daily supplements of thiamine, riboflavin, calcium pantothenate or pyridoxine. Slight acceleration of growth occurred when both thiamine and riboflavin were fed. Growth was markedly increased by administration of these two vitamins plus calcium pantothenate. In fact, it approximated the rate in rats fed yeast at a 10 per cent. level. The growth of rats given all four vitamin supplements was no greater than that in animals receiving only thiamine, riboflavin and calcium pantothenate. Detailed analysis of the data shows that pantothenic acid and riboflavin are limiting factors for growth in sunflower seed meal fed at the 5 per cent. level.

The sunflower seed meal is a light gray palatable powder. It can be satisfactorily blended with white flour and corn meal to make appetizing baked foods (as shown by the wife of one of us—H.G.D.).

These results reemphasize the importance of examining some of the ordinary, but neglected food materials available to us. They show that in common with wheat germ and corn germ,[5] sunflower seed may be of much more practical value in nutrition than has been recognized hitherto.

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THE HOMING INSTINCT IN PIGEONS[1]

IN his study of the problem of the sensory basis of bird navigation, Griffin[2] asks the question, "How does the bird know where to fly?" and then discusses fully much of the literature on the subject. He suggests that it seems more reasonable to explain the migratory and homing habits of birds by assuming that they use familiar landmarks, together with simple geographical, meteorological and ecological relationships rather than that they possess a new sense organ.

In an effort to obtain some additional information on the subject, especially on the necessity of training homing pigeons, trials were conducted in the spring and fall of 1944 at the New Jersey Agricultural Experiment Station. The pigeons used were reared at the substation of the Agricultural Experiment Station in Millville, N. J., and were flown on test from the headquarters of the Experiment Station at New Brunswick. In all instances the birds were shipped to New Brunswick by express and released within 24 hours after arrival.

The first trial was to determine whether young homing pigeons not previously trained from the loft would return home if released from New Brunswick, a straight-line distance by map of approximately 80 miles north-northeast of Millville. For the purpose, six youngsters hatched about January 1, 1944, were released individually at 5-minute intervals on April 6, 1944. None of the birds ever returned to their home loft in Millville. Weather conditions on the day of flight were fairly satisfactory; the air was clear and there was a brisk wind from the northwest. The wind would have had a tendency to carry the birds off a straight-line flight, but could hardly have been responsible for failure of the birds to return home. The birds apparently lacked all knowledge of home.

[5] Council on Foods and Nutrition, *Jour. Am. Med. Asn.*, 125: 848–49, 1944.

[1] Journal Series paper of the New Jersey Agricultural Experiment Station, Rutgers University, department of poultry husbandry.

[2] Donald R. Griffin, *Quarterly Review of Biology*, 19: 1, 15–31, March, 1944.

A second trial was conducted with birds that had received some flight training, as outlined in Table 1.

TABLE 1

SCHEDULE OF TRAINING FOLLOWED FOR BIRDS USED IN SECOND TRIAL

Flight number	Date	Approximate distance from home loft	Direction from home loft
		(miles)	
1	April 17	2	North
2	April 18	2	North
3	April 19	5	West
4	April 20	8	North
5	May 8	11	Northeast
6	May 9	22	North-northwest
7	May 12	16	North-northeast
8	May 19	40	North-northeast
9 (test flight)	June 1	80	North-northeast

The ten birds used were trained as a group, all birds being taken for each of the training flights. They were released individually at 5-minute intervals in New Brunswick on June 1. Previously they had returned home as a group from a point half way between the home loft and New Brunswick, a distance of approximately 40 miles. The weather was warm and partly cloudy with no perceptible wind. Of the ten birds released, two found their way back to the home loft, one 30 days later, and the other 48 days later. As a check group, eight untrained birds were released the same day. None of these ever returned to the home loft. The trained birds were 4½ months old, and the untrained birds 3½ months old.

In comparison with the first trial and the control group, even the training of the birds over 40 miles in the same direction as the 80-mile test flight failed to assist them materially in finding their way home when flown individually.

A third trial was conducted with birds flown over a longer period of time and as a group over the territory to be covered by the individual test flight, namely, from New Brunswick to Millville. The flying experience of the birds used is shown in Table 2, together with the results obtained. Of the nine birds flown, three never were heard from. Each bird carried a message holder with instructions enclosed to notify the author if the bird was picked up at any point, but no word ever was received regarding the three birds that

TABLE 2

PREVIOUS FLYING EXPERIENCE AND RESULTS OF HOMING PIGEONS FLOWN INDIVIDUALLY IN THIRD TRIAL

Bird No.	Age of bird (months)	No. of group flights in training	No. of group flights over test course (80 miles)	Time required to reach home
6906	9	5	2	7 hrs., 2 min.
6911	8	9	2	4 hrs., 50 min.
6919	8	8	2	Lost
6930	8	6	1	Lost
6931	8	18	1	6 hrs., 40 min.
6947	7	15	0	2 days
6954	7	16	1	4 hrs., 37 min.
6966	6	2	2	4 hrs., 28 min.
6972	6	1	1	Lost

did not return home. The six birds that returned home found their way back on the day of their release, with one exception, and that particular bird—which previously had not flown the course—came in two days later. Previous experience in flying over a particular territory certainly appeared to be highly desirable for birds when flown individually.

A point of interest in connection with the third trial was the fact that when flown as individuals the birds required from 4½ to 7 hours to find their way home, whereas on a previous flight as a group the birds covered the same distance in 2½ hours. Even on an additional flight in a fourth test, the birds as individuals required over 4 hours to come home. Weather conditions on all occasions were favorable and could not be considered as having affected the time required by the birds to find their home loft. Just why a group would know its way any better than the same birds as individuals is a point worthy of consideration and experimentation.

In summary, homing pigeons untrained in flights did not possess an instinct that would automatically take them back home when they were released individually at a point 80 miles from home. Even training for half the distance was of no avail. After once having flown with a group over the distance indicated, the majority of the birds, when flown as individuals, were able to find their way home.

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NEW JERSEY AGRICULTURAL EXPERIMENT STATION

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A COLORIMETRIC METHOD FOR THE MICRO-DETERMINATION OF 2,2, BIS(P-CHLOROPHENYL) 1,1,1 TRICHLORETHANE (DDT)[1]

THE efficiency of the compound 2,2 bis(p-chlorophenyl) 1,1,1 trichlorethane (DDT) as an insecticide, its tendency to remain effective for a long period of time and its cumulative toxic action,[2,3,4] makes it desirable that methods for the estimation of this sub-

[1] From the Chemistry Section, Antilles Department Medical Laboratory, U. S. Army.

[2] R. D. Lillie and M. I. Smith, *Pub. Health Rep.*, 59: 979–984, July 28, 1944.

[3] A. A. Nelson, J. H. Draize, G. Woodard, O. G. Fitz-

stance be developed in order that its usage may be controlled to the best advantage.

The current method of Smith and Stohlman[4] is open to certain objections. The ideal method should be sensitive enough to work with very low concentrations, accurate enough to detect small differences in these concentrations, and simple enough to be used for routine analysis. The proposed method fulfills these requirements.

Later publications will cover the application of this method to the determination of DDT in water, body fluids, tissues and foods.

Principle of the Test

It was found that when DDT is heated in an anhydrous pyridine solution containing xanthydrol (9-hydroxyxanthene) and solid potassium hydroxide, a red color develops which under proper conditions is proportional to the amount of DDT present. The reaction will detect as little as 10 gammas of DDT.

Reagents and Special Apparatus

(a) DDT Powder, dissolving, commercially pure 100 per cent. (Merck).

(b) Pyridine (Baker's Analyzed). It should be clear and colorless.

(c) Xanthydrol (Eastman Kodak).

(d) Potassium Hydroxide Pellets (Merck) U.S.P., average weight 125 mg per pellet. They should not have undergone deliquescence.

(e) Reflux Condenser Assembly. A 500 ml round bottom flask fitted with a ground-in all glass reflux condenser. In the absence of an all glass assembly, tinfoil covered cork connections may be employed. Rubber stoppers can not be used, as pyridine dissolves rubber.

(f) Oil Bath. A 500 ml beaker containing 200 to 250 ml of heavy liquid petrolatum, heated with a flame regulated so as to keep the temperature at 120° C ± 2°.

(g) Photoelectric Colorimeter. A Hellige-Diller Model No. 400 was used throughout. The colorimeter tubes were Hellige No. 452-D and the green filter used was No. 520.

Procedure

Preparation of the Xanthydrol-KOH-Pyridine Reagent: The reagent is prepared by placing in a dry 500 ml round bottom flask of an all-glass reflux-condenser assembly 50 ml of a 0.2 per cent. solution of xanthydrol in clear colorless pyridine. The assembly is set up in such a way that the contents of the flask may be mixed by swirling during the preparation of the reagent. The solution is brought to boiling by heating with a moderate flame through an asbestos-center wire gauze. As soon as boiling starts, 25 pellets of potassium hydroxide are added through the condenser. In order to prevent absorption of moisture by the potassium hydroxide, the pellets should be added directly from the bottle by using a small test-tube as a spatula. The boiling is continued and the contents of the flask mixed by swirling at 15 to 20 second intervals until the supernatant becomes dark green in color. The flame is then removed and when the boiling subsides the condenser is disconnected and the supernatant decanted, while hot, into a clean dry pyrex flask, being careful to leave the undissolved potassium hydroxide behind. Upon being transferred to the cold flask the supernatant immediately loses its green color. The reagent is now ready for use. It should be mixed well just before using, and it should be prepared fresh each day.

Reaction of the Reagent with DDT: A solution of DDT in ether containing 0.1 mg per cc is pipetted into a series of dry test-tubes (16 mm × 150 mm) so that the tubes contain 0, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 gammas of DDT. The tubes are then placed in the oil bath at 120° C for a few minutes to evaporate the ether. When the evaporation is complete the tubes are removed from the bath, 2 cc of Xanthydrol-KOH-Pyridine reagent added to each, and then replaced in the bath for 8 minutes. At the end of this time the tubes are immersed in cold water for 1 minute, removed and wiped free of oil and water and placed in a rack. (During the heating period the contents of the tubes undergo various color changes involving green, red and brown, depending upon the concentration of DDT. However, once the tubes are cooled by immersing in cold water, only the red or the initial yellow color of the reagent remains.) To each tube is now added 4 cc of pyridine. The contents are then mixed by inversion and transferred to dry photoelectric colorimeter tubes. Using a green filter (No. 520) the blank is set at zero on the Direct Reading (Concentration) scale. Readings are taken on all tubes within ten minutes after removal from the oil bath.

Discussion

Graph I is a curve plotted from data obtained by the above procedure. The reaction follows Beer's law to the extent that it can be used for the quantitative colorimetric determination of the substance. The sensitivity is such that small differences in concentration of DDT can be readily detected.

Different batches of reagent prepared on different days give constant results with known amounts of

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hugh, R. Blackwell and H. O. Calvery, *Pub. Health Rep.*, 59: 1009–1020, August 4, 1944.

[4] M. I. Smith and E. F. Stohlman, *Pub. Health Rep.*, 59: 984–993, July 28, 1944.

DDT, so that a standard color curve such as that shown in Graph I may be used as a basis for the determination of unknown amounts of this substance. Table 1 gives the direct colorimeter readings obtained with five different batches of reagent, prepared on

TABLE 1

COLORIMETER READINGS OBTAINED WITH DIFFERENT BATCHES OF REAGENT WITH KNOWN AMOUNTS OF DDT

Reagent No.	Concentration of DDT in Gammas 0	10	20	40	60	80	100	120	140	160	180
1	0	3.0	6.0	15.5	24	37	45	51	56	62	65
2	0	2.5	6.0	15.5	25	35	45	52	58	62	65
3	0	2.5	6.5	17.0	28	35	43	52	57	63	66
4	0	3.0	7.5	16.0	26	36	43	53	56	64	68
5	0	3.0	7.0	18.0	26	36	45	52	58	64	68

different days, when the reaction is carried out on known amounts of DDT.

The stability of the red color was studied by taking direct colorimeter readings on known concentrations of DDT at 5, 10, 15, 20, 30 and 60 minute intervals after removing the tubes from the oil bath. The results are shown in Table 2. It is recommended that readings be completed within 10 minutes after removal of the tubes from the oil bath, in order to render the effect of fading negligible.

During the course of the experimental work it was found that the reaction is most sensitive in detecting small differences in the concentration of DDT when applied to quantities of this substance ranging from 10 to 200 gammas. Water and alcohol must be absent, as both of these substances inhibit the production of the red color.

It will be noted that this reaction is similar to that

TABLE 2

COLORIMETER READINGS OBTAINED ON KNOWN CONCENTRATIONS OF DDT AT VARIOUS TIME INTERVALS AFTER HEATING

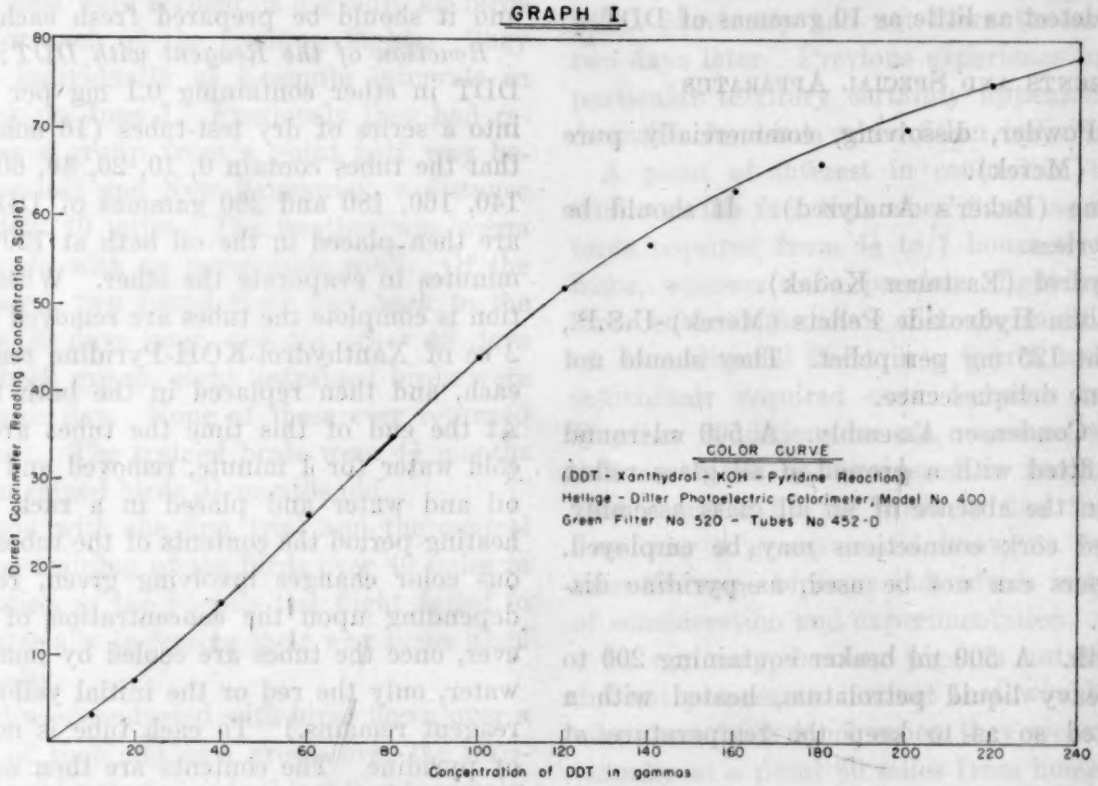
Minutes after heating period	Concentration of DDT in Gammas 20	60	100	140	180	220
5	6.0	28	46	58	68	75
10	5.5	27	45	57	67	74
15	5.0	24	43	55	65	72
30	4.5	21	41	51	62	72
20	3.7	17	35	47	60	65
60	3.0	13	26	39	48	56

described in the literature for chloroform and other R-C-halogen compounds with pyridine and sodium hydroxide.[5,6] However, DDT does not give the red color with pyridine and sodium or potassium hydroxide unless xanthydrol is present in the reaction. The possible interference of chloroform and allied substances is partially offset by the fact that most of these compounds will be eliminated during the process of evaporation of the ether at 120° C.

We are unable at present to explain the part that xanthydrol plays in the reaction. There seem to be two possibilities. The first is that the green dye formed when xanthydrol and solid potassium hydroxide are heated together may be the reactive substance. The other possibility is that xanthydrol, at the temperature used in the reaction, may break down DDT into one or more R-C-chlorine compounds which give the red color with pyridine and alkalie.

Due to the offensive odor of pyridine, the procedure for the test has been arranged in such a way as to

GRAPH I


Direct Colorimeter Reading (Concentration Scale)
Concentration of DDT in gammas
COLOR CURVE
(DDT - Xanthydrol - KOH - Pyridine Reaction)
Hellige - Diller Photoelectric Colorimeter, Model No 400
Green Filter No 520 - Tubes No 452-D

[5] W. H. Cole, *Jour. Biol. Chem.*, 71: 173–179, 1926.

[6] A. O. Gettler and H. Blume, *Arch. Pathology*, 11: 554-560, 1931.

btain the least degree of dissipation of the substance hen heated. For example, the test-tubes used are ng and narrow, thus acting as a reflux condenser hen the reagent is heated in the oil bath.

If deemed advisable all unused reagent and mixture rom the determination may be saved and the pyridine ecovered by simple distillation.

Summary

A colorimetric method for the micro-determination f 2,2 bis(p-chlorophenyl) 1,1,1 trichlorethane (DDT) s presented. The test is based on the discovery that hen DDT is heated in an anhydrous pyridine solu- ion containing xanthydrol and solid potassium hy- roxide a red color develops, which under proper onditions is proportional to the amount of DDT resent.

The reaction is sensitive to as little as 10 gammas f DDT. It will detect small differences in concen- ration within the range of 10 to 200 gammas. The est is relatively simple and can be run in a compara- ively short time.

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A SIMPLE VOLUMETER

DURING the course of some recent work it became necessary to determine the volume of turtle eggs. The volumeter described here was originally constructed for measuring eggs of 4 cc to 5 cc volume, but the principle can be utilized in similar devices of other size ranges. Methods for determination of the volume of very small glands have been described recently,[1,2] but the principles involved in these procedures could not be used in our problem.

The volumeter was made from a wide-mouthed glass-stoppered bottle of 250 cc capacity. The diameter of the mouth, not the volume, is the determining factor in selection of the bottle. A hole 10 mm in diameter was drilled down through the glass stopper. A 10 cc serological pipette graduated in tenths was then cemented into the hole, mouth end down, by means of plaster of Paris. Another hole of the same diameter was drilled through the side of the bottle 15 mm from the bottom and into this hole was inserted a rubber stopper of a size suitable to insure a tight fit. The tip of a 20 cc Luer syringe was inserted firmly into a small hole bored through the rubber stopper.

To operate, the bottle is first filled with water and a few cubic centimeters are drawn back into the syringe. The glass stopper carrying the pipette is inserted in the bottle and held in place to prevent lifting out when all the water in the syringe is returned to the bottle by pushing in the plunger. A few trials will determine the amount of water that must be first placed in the bottle and withdrawn into the syringe in order to obtain an initial reading near the lower graduations of the pipette. After the initial reading has been taken, sufficient water is then drawn back into the syringe to permit the removal of the stopper and allow the object to be measured to be placed in the bottle. With the object immersed in the water, the stopper is replaced, held firmly in position and the syringe plunger again pushed in all the way. The distance the column of water rises in the pipette above the initial reading indicates the amount of water displaced by the object. The final reading is then made.

Readings are easily reproducible to 0.1 cc and readings to 0.05 cc can be made if a pipette with graduations wide enough apart is selected for use.

The construction of the stopper and the insertion of the pipette should be such that the trapping of air-bubbles is avoided. While the use of a 10 cc pipette might seem to limit the usefulness of this particular device to a range within the capacity of the pipette, the measurement of eggs up to 15 cc volume was made. Eggs close to 10 cc volume were frequently encountered and when the initial reading lay near the 1 cc mark on the pipette, the final reading would go beyond the limits of the pipette if the plunger were pushed back into the syringe all the way. In these cases it was found that with a little practice accurate final readings could be made by returning the plunger only to the 5 cc mark on the barrel of the syringe, this 5 cc being added to the final reading obtained on the pipette. By using a syringe with a precision line engraved on the end of the plunger, accuracy is increased. Similarly, still larger eggs can be measured by returning the plunger only to the 10 cc mark. Another method of arriving at the same end would be to withdraw 5 cc or 10 cc of water from the bottle by means of a pipette after making the initial reading before putting back the stopper to make the final reading. This method would necessitate replacing water after each measurement to make initial readings. It is also possible that a number of stoppers of transparent plastic material might be made and fitted to the bottle so that a series of pipettes of different sizes would be available for the same device.

In our work the placing of the eggs in the bottle was facilitated by making use of a small wire net dipper with which to lower the eggs into the bottle and to remove them. With ordinary care, loss of water can be avoided in the operations attendant upon removing the glass stopper and lifting the wire dipper. The dipper is allowed to remain in the bottle

[1] C. A. Swinyard, *Anat. Rec.*, 74: 71, 1939.
[2] H. O. Burdick, *Endocrinology*, 28: 676, 1941.

during all the readings. With this volumeter, measurement can also be made of objects that float.

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PHENOL AS A TERMITE REPELLENT

TESTS previously reported[1] and still in progress, in preventing the attack of the West Indian dry-wood termite, *Cryptotermes brevis* (Walker), on most susceptible woods, indicate the value of heavily chlorinated or brominated compounds of phenol. Hexachlorophenol proves to be not as good as pentachlorophenol, but if substitution is made with copper, the resulting copper pentachlorophenate is much superior in repelling termites. Other metals of somewhat lesser value for this purpose, tested as sulfates, nitrates, chlorides, bromides and acetates, but not in other organic compounds, are zinc, ferric iron, cadmium and antimony. Minute amounts of some mercuric and mercurous salts initially make impregnated wood almost as powerfully repellent as do cuprous and cupric, but in the course of weeks or months, termites are able to eat the treated woods with impunity. Red mercuric iodide dissolved in acetone makes wood so toxic that termites die before they can crawl off the treated sample, but the wood quickly fades to its normal color and is then no longer either toxic or repellent.

Repeated tests with phenol, not in combination, indicate that its effect on the termites disappears even more rapidly. Service and laboratory tests of the phenolic glue used in the manufacture of plywood show that the termites usually begin feeding where the glue holds the sheets of wood together, although structurally this is not a point of weakness. Indeed, by comparison with other coal-tar constituents, phenol would seem one of the least promising upon which to build, except solely on the basis of low initial cost, to produce the ideal termite repellent.

[1] *Caribbean Forester*, 4 (4): 145–57, July, 1943, and 5 (4): 171–80, July, 1944.

Against the dry-wood termite, initial toxicity is of little importance as compared with permanence in remaining repellent, in which fluorene, phenanthrene, fluoranthene and pyrene are greatly superior (see Table 1).

The maximum effectiveness for this particular purpose would presumably be obtained by a combination of some of these organic compounds with the repellent metals. Or, if by heavy chlorination the relatively cheap naphthalene can be made to retain more permanently its initial toxic and repellent characteristics the result of combination with the metals might be preferable even to copper pentachlorophenate. So far as known, none of the suggested compounds is commercially or even experimentally available. But if the entomologist can record and interpret the reactions of the termites, the research synthetic chemist should be able to take advantage of this information and produce such compounds, specifically designed to protect susceptible wood and wood products from termite attack.

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TABLE 1

DAYS AFTER SUBMERSION TEN MINUTES OF WOOD SAMPLE BEFORE ATTACK BY THE WEST INDIAN DRY-WOOD TERMITE, *Cryptotermes brevis* (WALKER)

Dilution of	0.01%	0.02%	0.05%	0.1%	0.2%	0.5%	1%	2%	5%	10%
Phenol								2	3	4
Orthochlorophenol								4	7	9
p-Bromophenol							7	10	12	–
2,4-Dibromophenol							7	16	18	–
Tribromophenol							3	12	14	–
Thiophenol							8	10	13	–
Pentabromophenol					5	14	uneaten to date			
Pentachlorophenol				10	13	273	337	uneaten to date		
Hexachlorophenol					5	7	uneaten to date			
alpha-beta-Methylnaphthalene							6	9	12	–
3,5-Xylenol							4	54	–	
Fluorene						5	7	73	–	
Phenanthrene					4	7	8	87	–	
Fluoranthene			9	10	24	25	31	360	–	
Pyrene			2	4	19	25	182	195	–	
Copper Pentachlorophenate	27	42	uneaten to date							

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